Brown and Caldwell

# Health and Safety Plan
# For Phase II
# Remedial Investigation
# At The LCP Chemicals, Inc.
# Superfund Site

September 2006

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# HEALTH AND SAFETY PLAN
# FOR PHASE II REMEDIAL INVESTIGATION
# AT THE LCP CHEMICALS, INC. SUPERFUND SITE

**Prepared for:**

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**1361 Alps Road**
**Wayne, New Jersey 07470**

**Prepared by:**

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**September 2006**

**127806.207**

**HEALTH AND SAFETY PLAN**
**FOR**
**PHASE II REMEDIAL INVESTIGATION ACTIVITIES**
**AT THE LCP CHEMCIALS INC. SUPERFUND SITE**

Prepared by: Brown and Caldwell Date: August 28, 2006

Reviewed/approved by: _____ Date: 09-14-06
Scott MacMillin
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Reviewed/approved by: _____ Date: 09-14-06
Lydia Crabtree
Eastern Unit Safety Manager

Reviewed/approved by: _____ Date: 09-14-06
Matt Cavas
Project Geologist/Site Safety Officer

Reviewed/approved by: _____ Date: 09-14-06
Femke Hartog
Project Biologist/Site Safety Officer

Effective Dates: August 2006 to December 31, 2007

This document has been prepared for the express use of Brown and Caldwell and its employees and may be used as a guidance document by properly trained and experienced subcontractors. Due to the hazardous nature of this site and the activity occurring as part of the corrective action on-site, it is not possible to discover, evaluate, and provide protection for all possible hazards which may be encountered and this document does not guarantee the health and safety of any person entering this site. Strict adherence to the health and safety guidelines presented herein will reduce, but not eliminate, the possibility for injury at this site. Guidelines presented herein are site specific and should not be used for other sites without research and evaluation by a qualified health and safety specialist.

Each of the on-site subcontractors is responsible for their own health and safety program and the health and safety of their own employees. This requirement is based on OSHA regulations, which recognize the employer-to-employee responsibility for health and safety. A copy of their written program must be submitted for review to Brown and Caldwell, if requested. In an effort to assist the subcontractors, and to comply with hazard communication requirements, Brown and Caldwell will provide a copy of the site safety and health plan for this project to each subcontractor for implementation for the subcontractor's employees.

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# 1.0 INTRODUCTION

## 1.1 SCOPE AND APPLICABILITY OF HEALTH AND SAFETY PLAN

The purpose of this Health and Safety Plan (HASP) is to identify, evaluate, and control potential safety and health hazards and to provide emergency response procedures to incidents that may occur during field operations during the Phase II Remedial Investigation (RI) at the LCP Chemicals Inc. Superfund Site located in Linden, New Jersey (EPA ID# NJD079303020). The Phase II RI may involve well drilling and installation, soil borings, surface water and sediment sampling, biota sampling, water level measurements, groundwater sampling, site survey/site reconnaissance, and investigation derived waste sampling at the LCP Superfund Site located at the foot of South Wood Avenue in Linden, New Jersey. This HASP covers only those Brown and Caldwell personnel who are working at the site and who have potential for exposure to hazardous waste, hazardous substances, contaminated groundwater, or a combination of these materials.

This HASP complies with the standards of the Occupational Safety and Health Administration (OSHA) as stated in 29 CFR with emphasis on subsections:

| | |
|---|---|
| 1910.120 | (Hazardous Waste Operations and Emergency Response), |
| 1910.1000 | (Toxic and Hazardous Air Contaminants), |
| 1910.1200 | (Hazard Communication, Employee Right-to-Know Law), |
| 1904 | (Recording and Reporting Occupational Injuries and Illnesses), |
| 1990 | (Identification and Regulation of Potential Occupational Carcinogens), |
| 1926 | (Safety and Health Regulations for Construction); and other applicable federal and state statutes or regulations. |

Amendments to this Plan will be made as the contaminant profile information is updated, a change in work status or task is made, or as regulatory requirements dictate. Changes to this Plan will be brought to the attention of people covered under the Plan through additional training and appropriate notification as required.

## 1.2 SITE BACKGROUND

ISP Environmental Services, Inc. (ISP-ESI) has been identified by the USEPA as a Potentially Responsible Party (PRP) at the LCP Chemicals. Inc. (LCP) Superfund site in Linden, New Jersey. The site is located immediately adjacent to the ISP-ESI Linden, New Jersey, site and is also bordered by the Valero L.P. petroleum terminal. A Site Location Map is provided in Figure 1-1.

The site was originally owned by E.I. duPont de Nemours and Company and was purchased by GAF Corporation (GAF), a predecessor to ISP in 1949. GAF sold the property to LCP in 1972 and production ceased at the site in 1985. Chlorine and sodium hydroxide were produced at the site using the mercury cell electrolysis process. Sludge containing mercury was placed in a brine sludge lagoon.

Various investigations at the site identified the presence of mercury at elevated levels in soils, and adjacent surface waters and sediments. In addition to mercury, relatively low levels of other organics have also been detected including PCBs, chloroform, benzene, chlorobenzene, dichlorobenzenes, hexachlorobenzene, and naphthalene.

The site was included on the National Priorities List (NPL) on July 27, 1998 and a Consent Order was signed by ISP-ESI in May 1999. Under terms of the Consent Order, ISP-ESI must conduct a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS must be conducted in conformance with the Statement of Work (SOW) identified in the Consent Order. Addenda to the RI/FS work plan have been prepared and submitted to USEPA for review with respect to the Phase II RI.

## 1.3 FIELD ACTIVITIES FOR THE WORK PLAN

The activities to be covered by the HASP have been identified and are discussed in detail in the Work Plan. The work has been divided into individual field activities as summarized on Table 1-1 with additional details described in Section 3.0, Health and Safety Hazards.

## 1.4 PERSONNEL REQUIREMENTS

To promote safe work practices, no inherently hazardous activity will be conducted by an individual employee working alone. At least one Brown and Caldwell employee and an employee of a subcontractor (e.g. drilling company) will be present at the site during intrusive field activities such as well drilling and installation, and field work performed at or in the vicinity of South Branch Creek. During typical work activities, such as water level monitoring and groundwater sampling, the buddy system is suggested, but not required.

Best Management Practices require the wearing of safety glasses with side shields by personnel in site areas with the exception of the parking areas. Hard hats may also be required at certain times in designated areas. Designated areas and times that require the use of hardhats will be decided by the Site Safety Officer (SSO), and discussed in a site safety meeting. As a minimum, a monthly site safety meeting will be conducted to address current site conditions and operations which effect site personnel. Daily site meetings (a.k.a. tailgate meetings) will be held on an as needed basis to discuss changes in work or Personal Protective Equipment (PPE), and accidents that may have occurred during the previous day will be discussed and prevention methods implemented.

All personnel working on this project will have a quantitative respirator fit test and will have a full-face respirator with combination organic vapor and mercury cartridges available while at this site. When working in areas with potential mercury contamination, employees will wear protective suits, nitrile or neoprene gloves, and shoe covers. Employees will use tape to seal around the seams and will discard this clothing each time upon exiting this area. This will help reduce the potential spread of mercury.

# 2.0 PERSONNEL AND SITE DOCUMENTATION

## 2.1 KEY PERSONNEL

Scott MacMillin is the project manager (PM). Lydia Crabtree is the Eastern Unit Safety Manager (EUSM). Matt Cavas is the project geologist and will function as a project Site Safety Officer (SSO). Femke Hartog is the project biologist and will function as a project SSO. The PM or a project SSO may designate an alternate based upon personnel selected to conduct the fieldwork. The project field staff have completed 40 hours of comprehensive health and safety training, which meets the requirements of Title 29, Code of Federal Regulations Part 1910.120 (29 CFR 1910.120). The SSO has the authority to monitor and correct health and safety problems as noted on site.

The PM is responsible for generating, organizing, and compiling the HASP, which describes all planned field activities and potential hazards that may be encountered at the site. The PM is also responsible for ensuring that adequate training and safety briefing(s) for the project are provided to the project team. The PM will provide a copy of the HASP to each member of the project field team and one copy to the subcontractor before the start of field activities.

The EUSM is responsible for developing and coordinating the Brown and Caldwell (BC) health and safety program. For specific projects, the EUSM is responsible for reviewing and approving the draft HASP for accuracy and incorporating new information or guidelines that aid the PM and SSO in further definition and control of the potential health and safety hazards associated with the project.

On a daily basis during field operations, the SSO shall visually inspect site activities for compliance with this HASP. Appropriate documentation of this inspection shall be noted in the site field logbook. Deficiencies in compliance will be corrected as soon as practical. The corrective action taken shall be noted in the site field logbook as well as when the corrective action is completed. The following items further define the responsibilities of the SSO:

1. Ensuring employees follow the HASP.
2. Reporting to the PM any unsafe conditions or practices.
3. Reporting to the PM all facts pertaining to incidents that result in injury or exposure to toxic materials.
4. Reporting to the PM equipment malfunctions or deficiencies.
5. Providing site safety briefing for team members.
6. Updating equipment or procedures to be used on site on the basis of new information gathered during the site investigation.
7. Ensuring employees inspect personal protective equipment (PPE) before on-site use.
8. Assisting the PM in documenting compliance with the HASP by completing the standard BC forms.
9. Assisting in and evaluating the effectiveness of decontamination procedures for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles.
10. Enforcing the "buddy system" as appropriate for site activities.
11. Posting location and route to the nearest medical facility; arranging for emergency transportation to the nearest medical facility.
12. Posting the telephone numbers of local public emergency services; i.e., police and fire departments.
13. Stopping operations that threaten the health and safety of the field team or surrounding populace.
14. Entering the exclusion area in emergencies after he/she has notified emergency services.
15. Observing field team members for signs of exposure, stress, or other conditions related to pre-existing physical conditions or site work activities.

## 2.2 PROJECT CONTACTS

The following is a reference list of project contacts:

| | |
|---|---|
| Client: | ISP-ESI<br>1361 Alps Road<br>Wayne, NJ 07470 |
| | |
| Client Contact: | Dave McNichol<br>(973) 628-3355 - office<br>(973) 445-4524 – mobile<br>dmcnichol@ispcorp.com |

| | |
|---|---|
| Client Site Contact: | John Vandersteen<br>(908) 474-5102 - office<br>(908) 296-2412 - mobile |
| | |
| BC Project Principal: | Jeffrey Caputi<br>(201) 574-4700 ext 4742 - office<br>(201) 819-4330 - mobile<br>jcaputi@brwncald.com |
| | |
| BC Project Manager: | Scott MacMillin<br>(201) 574-4700 ext. 4711 - office<br>(201) 841-0350 - mobile<br>smacmillin@brwncald.com |
| | |
| BC Ecology Task Manager: | Tamara Sorell<br>(201) 574-4700 ext. 4758 - office<br>(973) 519-5359 - mobile<br>tsorell@brwncald.com |
| | |
| Eastern Unit Safety Manager: | Lydia M. Crabtree<br>(615) 250-1236 - office<br>(615) 202-1311 - mobile<br>lcrabtree@brwncald.com |
| | |
| Project Geologist/SSO: | Matt Cavas<br>(201) 574-4700 ext. 4746 - office<br>(201) 213-8712 - mobile<br>mcavas@brwncald.com |
| | |
| Project Biologist/SSO: | Femke Hartog<br>(201) 574-4700 ext. 4701 - office<br>(646) 415-3701 - mobile<br>fhartog@brwncald.com |
| | |
| Alternate SSO: | Brian Snyder<br>(201) 574-4700 ext. 4750 - office<br>(201) 669-9959 - mobile<br>bsnyder@brwncald.com |
| | |
| Alternate SSO: | Thakur Chaturgan<br>(201) 574-4700 ext. 4752 - office<br>(201) 841-1801 - mobile<br>tchaturgan@brwncald.com |
| | |

| | |
|---|---|
| Field Personnel: | Courtney Lia<br>(201) 574-4700 ext. 4706 - office<br>(201) 669-1060 - mobile<br>clia@brwncald.com |

The following emergency telephone numbers will be used to call for assistance:

| | | |
|---|---|---|
| **Local Hospital** | Robert Wood Johnson<br>University Hospital at Rahway | 732-381-4200 |
| **Emergency Care:** | Police (Non-emergency) | 908-474-8500 |
| | Police | 9-1-1 |
| | Ambulance | 9-1-1 |
| | Fire | 9-1-1 |

## 2.3 SITE VISITORS

First time visitors to the site must receive site orientation from the SSO prior to entering the site. Orientation must include identification of restricted areas such as Exclusion Zones and active operations, site emergency procedures and equipment, emergency phone numbers, and directions to the local hospital.

Visitors and contractor personnel whose work activities require entry into the Exclusion Zone must acknowledge their understanding of this HASP. In addition, these contractors must comply with the general requirements found in "Personnel Training Requirements" (Section 4.0), "Personal Protective Equipment" (Section 5.0), "Medical Surveillance Requirements" (Section 6.0), and "Site Control Measures" (Section 8.0) of this HASP.

Personnel entering the site are required to acknowledge reading this Health and Safety Plan (Attachment 1), and to adhere to the HASP requirements while in the vicinity.

## 2.4 SUBCONTRACTOR RESPONSIBILITIES

All subcontractors are responsible for their own health and safety programs and the health and safety of their own employees. This requirement is based on OSHA regulations, which recognize the employer-to-employee responsibility for health and safety. A copy of their

written program must be submitted to BC for review, if requested. In an effort to assist the subcontractors, and to comply with hazard communication requirements, Brown and Caldwell will provide a copy of the site safety and health plan for this project to the subcontractor for implementation for the subcontractor's employees.

# 3.0 HEALTH AND SAFETY HAZARDS

## 3.1 HAZARD ANALYSIS FOR WORK ACTIVITIES

A hazard analysis for each identified Brown and Caldwell work activity covered by this HASP can been found in Table 3-1. This table provides a summary of anticipated task activities for this site, associated task hazards, and protective measures to be followed to reduce the hazard potential. This table will be updated by the PM and/or SSO as job activities change.

Precautions will be taken to avoid the following common work place hazards:

- Slips, Trips and Falls
- Electrical
- Mechanical
- Fire/Explosion
- Heat and Cold Stress
- Noise (Acoustical)

The SSO will evaluate these potential hazards during site inspections. Routine and potential equipment hazards will be discussed during site safety meetings. Workers will be advised of known potential hazards at the site prior to beginning work, and, as required, if site conditions change. Equipment will be operated by trained personnel and employees will be cautioned during site safety meetings to be aware of moving equipment. Employees should be encouraged to be observant of site safety and health hazards, to watch out for other workers, and to report unsafe conditions to their supervisors and the SSO.

Safety glasses with side shields, steel-toed boots, coveralls, hearing protection and hard hats will be required to be worn at certain times in designated areas. Fire extinguishers, respirators, first aid kits, and eyewash stations will be available for use as needed in the work

area. Site workers will be trained in their use prior to arrival on site and visitors will be advised of their availability and location.

## 3.2 IDENTIFICATION OF POTENTIALLY HAZARDOUS CHEMICALS

Potentially hazardous chemicals present in the various site media including; soils, sediment, surface water and groundwater have been previously determined during earlier investigations. These primarily include mercury, however, relatively low levels of other organic constituents have also been detected including PCBs, chloroform, benzene, chlorobenzene, dichlorobenzenes, hexachlorobenzene, and naphthalene. The potential routes of exposure to these site media include:

- Inhalation of vapors or dusts from the site materials.

- Direct dermal (skin) contact or absorption of contaminants contained in the site media.

- Ingestion by hand-to-mouth transfer of contaminants.

The available data reveal that the primary chemical constituent known to exist at the site is mercury. The mercury is known to exist in the metallic form. It is unknown whether mercury also exists in other forms including inorganic mercury compounds and/or methyl mercury.

Table 3-2 presents the chemicals of interest and their current occupational exposure levels. The Permissible Exposure Limits (PEL) established by the Occupational Safety and Health Administration (OSHA) reflect both the vacated final rule values of 1993 as well as the less stringent values found in the earlier Air Contaminants Standard (29 CFR 1910.1000). The Recommended Exposure Limits (REL) were from the 1994 edition published by the National Institute for Occupational Safety and Health (NIOSH), and the Threshold Limit Values (TLV) published by the American Conference of Governmental Industrial Hygienists

(ACGIH) are from the latest edition. Each occupational exposure limit is based upon known and available medical, biological, engineering, chemical, trade, and other relevant information to reduce or eliminate the adverse health and safety effects of these chemicals. Additional chemical information on site constituents can be found in the NIOSH Pocket Guide to Chemical Hazards as well as in generic Material Safety Data Sheets (MSDS). Additional information regarding the chemicals of interest is presented as follows:

**Mercury -** At room temperature mercury is a liquid. It does have sufficient vapor pressure to volatilize at room temperature which may lead to personal exposure to mercury vapor. Acute poisoning due to mercury vapors affects the lungs primarily in the form of acute interstitial pneumonitis, bronchitis, and bronchiolitis. Exposures to lower levels over prolonged periods produce symptoms that vary from individual to individual. Four classic signs that are rarely seen together include: gingivitis, gastrointestinal distress, increased irritability and muscular tremors. The primary health effect due to chronic exposure to mercury vapor is damage to the central nervous system. It is irritating to the eyes and skin on contact.

To present a health hazard, mercury must be in such a form as to gain entrance into the body or tissue in measurable quantities. The primary mode of entry that is of concern is inhalation of mercury fume, and secondary, is ingestion if poor personal hygiene is practiced. Mercury is a cumulative poison. It is stored in the body and acts as a cellular poison to organ systems before symptoms and disability is evident. Mercury poisoning damages organs and tissues of the body such as kidneys, liver, blood vessels, nervous system and reproductive organs. Chemical and physical properties may vary depending upon the specific mercury compound.

**PCBs -** PCBs are colorless to light yellow, viscous liquids (above 50°F) that can be detected by their mild hydrocarbon odor. PCBs are non-flammable but are strong oxidants. The routes of exposure for PCBs are inhalation, ingestion, and skin and eye contact leading to absorption. PCBs exposure is known to target the skin, eyes and liver. The primary effect of exposure to PCBs is a type of dermatitis known as chloracne associated with skin contact. These compounds are suspected carcinogens based on animal studies.

**Chlorobenzene -** Chlorobenzene is a colorless flammable liquid with an almond-like odor. It is incompatible with strong oxidizers. Routes of exposure are inhalation, ingestion, skin and/or eye contact. Symptoms include irritation of eyes, skin, nose; drowsiness, uncoordination; and central nervous system depressant/depression.

**1,2-Dichlorobenzene (o-Dichlorobenzene) -** 1,2-Dichlorobenzene is a colorless to pale-yellow combustible liquid with a pleasant, aromatic odor. It reacts with strong oxidizers, aluminum, chlorides, acids, and acid fumes. Exposure routes include inhalation, skin absorption, ingestion, skin and/or eye contact. The vapor irritates the eyes, the skin and the respiratory tract. The liquid, left on the skin may produce blistering. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness.

**1,3-Dichlorobenzene (m-Dichlorobenzene) -** 1,3-Dichlorobenzene is a combustible liquid that reacts with oxidizing agents, aluminum, and its alloys). Exposure routes include inhalation, skin absorption, ingestion, skin and/or eye contact. The vapor irritates the eyes, the skin and the respiratory tract.

**1,4-Dichlorobenzene (p-Dichlorobenzene) -** 1,4-Dichlorobenzene is a colorless or white crystalline solid with a mothball-like odor. It is a combustible solid, but it may take some effort to ignite. It is incompatible with strong oxidizers (such as chlorine or permanganate). Routes of exposure include inhalation, skin absorption, ingestion, skin and/or eye contact. Symptoms of exposure include eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury. It is considered a potential occupational carcinogen.

**Carbon Monoxide -** Carbon monoxide (CO) is a colorless, odorless, tasteless gas. The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea. These initial symptoms may advance to vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. Coma or death may occur if high exposures continue.

**Hazard Prevention**

For inhalation, prevention of exposure is accomplished by appropriate dust and vapor control measures and/or through the appropriate use of air-purifying or air-supplying respirators. For direct dermal contact or absorption, prevention of exposure is accomplished by the proper selection and use of protective clothing. For ingestion, prevention is accomplished through good hygiene practices, frequent hand washing, and enforcement of site rules regarding eating, drinking, and smoking restrictions.

Site personnel will receive training about the potential chemical risks from the compounds known to be present at the site. Appropriate site controls and PPE will be utilized to further reduce potential chemical exposure.

## 3.3 HAZARD COMMUNICATION PROGRAM

The OSHA Hazard Communication (Haz-Com) Standard found in 29 CFR 1910.1200, requires that hazard information on workplace chemicals be communicated to workers present at a site. The PM shall be responsible for the development and administration of the site Haz-Com program which includes the written program, a warning label system, MSDS information, and employee training.

MSDS information on calibration and decontamination chemicals brought to the site by Brown and Caldwell personnel will be maintained on site for review in a separate document.

All contractors must supply Brown and Caldwell with a list of chemicals that they will bring onto the site and the MSDS for each chemical. Contractors must also apply labels on chemical containers brought into the work place. When contractors are finished working at the site, they must either dispose of or take with them unused chemicals brought onto the site.

## 3.4 DRILLING HAZARDS

During all drilling operations ensure that the appropriate level of protection and safety procedures is utilized. Hard hats, steel-toed boots, and ear and eye protection will be required at all times when working around drill rigs. The proximity of chemical, water, sewer, and electrical lines is to be identified before any drilling is attempted. Additionally, the employee can effectively manage hazards associated with working around heavy equipment if a constant awareness of these hazards is maintained. These hazards include the risk of becoming physically entangled in the equipment or being run over, slipping and falling, impact injury to eyes, head and body, and injury from machinery operations. Never work or walk under a load suspended on drill rigs or heavy equipment. Never work or walk on piles of well casings. Make sure all high-pressure lines and hoses have whip checks attached. Constant visual or verbal contact with the equipment operator will facilitate such awareness.

## 3.5 WELL SAMPLING AND MEASUREMENT HAZARDS

Potential hazards associated with well sampling and measurement are listed below:

- Potential exposure to volatile organic vapors (VOCs) and mercury vapors when opening the wellhead.
- Back strain due to lifting bailers or pumps from down-well depths and moving equipment to well locations.
- Slip and fall potential from wet, muddy, or snow-covered surfaces created by spilled water or inclement weather.
- Electrical hazards associated with the use of electrical equipment around water or wet surfaces.
- Splash potential from groundwater into the eyes during sampling.
- Potential exposure to sample preservatives and decontamination chemicals.

Hazard Prevention

- To minimize the potential of exposure to VOCs and mercury vapors when initially opening the wellhead, air-monitoring devices (Photo Ionization Device (PID) and mercury vapor analyzer (MVA) also known as a Jerome) should be placed near the opening. The area of the breathing zone will also be monitored. Adequate protective clothing will be provided to prevent dermal contact with the groundwater. PPE, including respiratory protection, shall be assigned and utilized as needed depending on the results of the air monitoring and action levels established in this HASP.

- Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment will be lifted using proper lifting procedures. Lift with the legs, and when needed, get the help of others.

- Slipping on wet surfaces will be prevented by placing purged water in drums for removal. A boot with a good tread for traction will be used to minimize the potential of slipping.

- Ground fault interrupters will be used when pumps are operated in or around wet conditions.

- Appropriate eye protection will be worn to prevent water splashing into the eyes. At a minimum, safety glasses with side shields are required to be worn at all times. If there is a high potential for liquid splashes, goggles must be worn.

- Gloves and other PPE should be worn, as required, to prevent contact with preservative and decontamination chemicals.

## 3.6 MARINE SAFETY

Note that BC will always observe the "Buddy System" when working on or in close proximity of water. To minimize mercury contamination, any equipment such as oars and boats will be thoroughly decontaminated. Any equipment such as personal flotation devices, waders, etc., will be disposed.

This section establishes guidelines for the safe operation of Class A boats only during BC field activities such as biological sampling, sediment sampling, and bathymetry. A class A boat is less than 16 feet long. Class A has the greatest numbers of boats. They can all be car topped or trailered. Due to their lightness and small size, many can become unstable if weight in them is excessive or carelessly loaded. Too much weight makes these boasts sluggish, reduces their freeboard (the height of their sides above water) and can swamp (flood) them.

Boarding Small Boats

Be sure that the boat is secure. With one hand on the boat, quickly lower yourself straight down into the center of the boat. A life preserver should be worn (as described below). If others are boarding, the operator should have him/her also quickly lower themselves into the boat. To move around a boat, one should step along the fore-and-aft centerline of the boat while the boat is held in place along the pier.

Drowning Hazards/Personal Flotation Devices

A personal flotation device (PFD) must be worn when working on a boat. The minimum required protection is a TYPE III PFD, or flotation aid. This type of PFD is similar to a jacket in style and is designed so that wearers can put themselves in a face-up position in the water. The wearer may have to tilt their head back to avoid turning face down. TYPE III has the same minimum buoyancy as a TYPE II PFD. Float coats, fishing vests, and vests designed for various water sports are examples.

Loading of Boats

Avoid carrying anything aboard. Step down into the boat and load the items off the pier, or have someone hand them to you one by one. In a small utility boat, keep weight toward the middle, both fore-and-aft and side-to-side. Amount and location of weight (persons and gear: the movable ballast) is critical for capsize protection. If you see waves approaching, take them on the bow. Overloading a small boat inhibits its ability to rise to oncoming waves. Less freeboard means less clearance above the water's surface to prevent swamping. All craft must be operated within the boat manufacturers weight limits.

Boat Safety Equipment For BC-Operated Class A Boats

- All persons on the boat will wear a U.S. Coast Guard approved Type III personal flotation vest. In addition, throwable Type IV devices will be readily available for use.

- At least one 1A-10BC Type U.S. Coast Guard approved hand-held portable fire extinguisher will be on the boat, readily available for use.

- Visual Distress Signal Flares and a battery operated light will be in good working order and readily available on the boat.

- A sound-producing distress signal, either bell, whistle, or horn, will be in good working order and readily available on the boat.

- A first aid kit will be available on shore to minimize gear and prevent tripping hazards within the boat.

- All boat fuel (gasoline) will be contained in engine manufacturer's approved containers that supply fuel to the engine via neoprene fuel lines. No fuel transfers between containers are to be conducted aboard the boat.

- A secondary means of propulsion will be available on the boat (oars or paddle).

- A boat hook, anchors, and proper mooring lines will be available on the boat.

Safe Boating Operations

- All boats will be properly registered for use in waterways of local, state, and federal jurisdictions.

- All boat trailers and towing vehicles will be properly licensed and in good working order.

- The boat will only be operated by experienced personnel. The U.S. Coast Guard Auxiliary and other organizations regularly sponsor boating safety courses. In addition to basic boating safety, the courses cover navigation regulations and emergency procedures. The training is recommended, even for experienced boat operators.

- The boat will be operated in a safe manner and all waterway regulations will be obeyed.

- No smoking or alcoholic beverages are permitted on the boat.

- No recreational equipment for fishing, hunting, water skiing, or SCUBA diving will be allowed on the boat unless specifically authorized as part of the work-related equipment.

- No steel-toed, rubber boots or waders may be worn on the boat. Light weighted shoes like sneakers are recommended.

Boating Accidents

Coast Guard regulations, as well as state regulations, require accident reports if significant injuries or property damage occurs. It is normally best to stay with the boat in case of an accident and use signal flares or a distress horn to summon help. Hypothermia (cold stress) is a significant risk for those involved in boating accidents due to the rapid conduction of body heat by cold water. Wet or dry suits are recommended for cold weather/cold water operations.

## 3.7 USE OF WADERS

Waders may be used at the site as an alternative to a Class A boat when sampling locations are accessible from the shoreline. Waders will NOT be used in the boat. Use of waders will only be permitted during the active implementation of the buddy system (i.e., two or more field personnel). The buddy shall be prepared with a "ring"-type buoy attached to a throw bag which has been anchored to the shore for use in the event of an emergency.

If an employee falls in the water, the chances of drowning are high because waders can quickly flood with water and drag a person under. A person can end up in the water if the person wearing waders overbalances and/or slips on a slippery surface (algae covered rocks) or trips on an uneven walking surface. A sturdy stick, wading staff or ski pole can help maintain at least two points of contact with the streambed/walking surface. The following are some tips to help keep you afloat should you end up in the water while wearing your waders.

- If you feel unstable in a fast current with a rocky bottom, try wading with same foot always leading (single step) and other foot always trailing. Single stepping makes for a slower crossing, but a more stable one.

- To restrict the amount of water that can enter the waders, fasten a belt firmly around the waist without restricting movements and maintaining comfort. The belt will trap air inside providing the wearer with some buoyancy that will help keep them afloat.

- If you fall into the water, immediately get into a tuck position. This will allow the air in the waders to remain trapped and will also limit the amount of water that will leak in. Once "tucked," roll onto your back, keeping the knees tucked in all the time. Use your arms to balance yourself.

- You must not try to swim. Either tread water or float in an upright position. If close to shore, use a back sculling action to get to shore. If swept into a fast flowing current/stream, always face downstream and go with the current, feet first.

- Always remember not to panic and remember the simple steps.

It should also be noted that waders are meant to keep occupants dry and warm and thus may result in an increased risk of heat stress.

## 3.8 NON-PERMIT CONFINED SPACE ENTRY

***NOTE***: For this project it is NOT anticipated that confined space entry will be required. Personnel believing that confined space entry is necessary to perform or complete a task MUST OBTAIN APPROVAL from the PM.

A HASP ADDENDUM, including the Brown and Caldwell Confined Space Entry Procedures Section 205 of the Brown and Caldwell Health and Safety Manual, will be prepared for the confined space entry and a confined space entry trained team will be sent to the site to complete the task.

For identification and informational purposes, a non-permit required confined space is defined by the following criteria:

- Is large enough and so configured that an employee can bodily enter and perform assigned work;
- Has limited or restricted means for entry or exit;
- Is not designed for continuous human occupancy; and
- Atmosphere contains a minimum of 19.5% oxygen.

## 3.9 ILLUMINATION HAZARDS

Fieldwork in non-illuminated areas should not occur during periods of darkness. If situations require working in the dark, illumination should be provided according to levels specified in Table 3-3 for work areas in 29 CFR 1910.120(m), Table H-102.1. An illumination meter can be purchased or rented for the purpose to measure illumination intensities in specific areas.

## 3.10 BIOLOGICAL HAZARDS

The potential to encounter various reptiles, insects, and poison ivy in the course of completing the work plan covered by this HASP is considered highly probable. The geographic location, the climate, the biota, and the location of the site tend towards the creation of a suitable habitat for snakes, insects, and poison ivy. Precautions will be taken by all on-site personnel to avoid prime snake and insect habitats, to protect oneself, and assist other personnel from attack or encounter.

***NOTE***: An encounter with a poisonous snake requires immediate professional medical attention.

Ants, bees, and wasps are considered to be the most common insects that may be encountered. Although their bite is not considered life threatening, an allergic reaction to these bites could occur. Avoid insect habitats whenever possible.

If bitten by insects, remove the stinger by gently scraping it out (do not use tweezers). Apply ice to the affected area. Instant ice packs are to be kept in the work area. If the worker is bitten by an insect, immediately apply an ice pack to the affected area and wash area with soap, apply antiseptic. If an allergic reaction occurs, transport worker to the closest medical facility for treatment.

## 3.11 LYME DISEASE PREVENTION

The prevention of Lyme Disease is important during spring, summer and fall months. Lyme Disease is a bacterial infection transmitted by the bite of a deer tick. About 50 percent of deer ticks carry the Lyme Disease bacteria.

To prevent the bite of a deer tick, avoid grassy areas when possible. Wear protective clothing (light colored) with long sleeves and pants tucked inside of socks. Use repellent containing "Permethrin" or "Deet". These repellents should be applied to clothing and not directly on the skin. Make self-inspection a habit following exposure to an area which may contain deer ticks.

- *Symptoms*: headache, flu-like symptoms, a spreading ring-like rash, swelling and pain of the joints.

- *Tick Removal*: Remove attached tick immediately. Use tweezers to grasp the tick's head, near the skin, and slowly pull straight out. If possible, save the tick for laboratory analysis.

Report incidents involving deer tick bites to Brown and Caldwell's Project Health and Safety Manager.

## 3.12 POISON IVY, OAK, AND SUMAC PREVENTION

Poison ivy may be encountered in the grassy/wooded areas on this site. Precautions include wearing gloves when clearing brush and staying on pathways when possible. Poison ivy, oak, and sumac plants cause contact dermatitis or an allergic reaction in about 90 percent of all adults. To prevent contact, wear protective clothing (Tyvek, long sleeves, gloves). Remove clothing without touching the outside of the garments that may have come in contact with the plants.

- *Signs and Symptoms*: A day or two is the usual time between contact and the onset of symptoms.

  - Mild reaction: some itching.
  - Mild to moderate reaction: itching and redness.
  - Moderate reaction: itching, redness, and swelling.
  - Severe: itching, redness, swelling, and blisters.

- *First Aid:* Those knowing that they have had contact with a poisonous plant should take immediate action within five minutes. The action includes rinsing with brown soap and water or using alcohol. During the acute or weeping and oozing stage, sodium bicarbonate (baking soda) solution should be used. If symptoms are severe, contact the PM and/or SSO for instructions for treatment by a physician.

## 3.13 WEATHER RELATED STRESSES

Weather related stress can be either heat or cold related. Table 3-4 provides a summary of the differences between Heat Exhaustion and Heat Stroke. Heat Stroke is a life threatening medical condition and requires immediate medical attention.

<u>Sunburn</u>

Working outdoors with the skin unprotected for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

Heat Stress

The potential for heat stress is a concern when field activities are performed on warm, sunny days and is accentuated when chemical protective clothing is worn. Heat stress prevention measures and monitoring will be implemented if site temperatures are above 70 degrees Fahrenheit (F). Heat stress due to water loss can be prevented. To prevent dehydration, water intake must approximate sweat loss. Water intake guidelines are as follows:

1. The sense of thirst is not an adequate regulator of water replacement needs during heat exposure. Therefore, water must be replaced at prescribed intervals.

    a. Before work begins, drink two 8-ounce glasses of water.
    b. During each rest period, drink at least two 8-ounce glasses of water.

2. Plain water, served cool, is excellent. An adequate supply of potable water and drinking cups will be readily available, such as in a support vehicle, to provide water during rest periods.

3. Adding salt to water is not recommended. Acceptable alternatives to water include dilute fruit juices and electrolyte replacement drinks diluted 3:1 with water. Do not use salt tablets!

An initial work/rest cycle of 1 hour work and 15 minutes rest is recommended for protection of staff when the heat stress hazard is high. The recommended cycle will be adjusted up or down on the basis of worker monitoring data, environmental conditions, and the judgment of the SSO. If at any time field team members recognize the signs or

symptoms of heat stress before a scheduled rest period, they will notify the SSO immediately in order that a rest period can be called.

Heat stress, if not prevented, results in heat stress illnesses. Two critical illnesses, if not recognized and treated immediately, can become life-threatening. These are heat exhaustion and heat stroke and are further described in the following subsections.

Heat Exhaustion

The signs and symptoms of heat exhaustion are headache, dizziness, nausea, weakness, fainting, profuse sweating, loss of appetite, approximately normal body temperature, dilated pupils, weak and rapid pulse, shallow and rapid breathing, possible cramps in abdomen and extremities, possible vomiting, difficulty walking, and/or skin that is cool and sweaty to the touch and pale to ashen-gray coloring.

**First aid for heat exhaustion is as follows:**

1. Immediately remove victim to the support area, or if you are the victim, proceed to the support area.
2. Decontaminate victim, if practical, before entering support area.
3. Start cooling, but be careful not to cause a chill (i.e., rest in shade and apply wet towel to forehead; open up and/or remove clothing to the extent practical, especially chemical-resistant clothing).
4. Have victim drink cool water slowly, but only if conscious and not in shock.
5. If the victim is vomiting and/or other signs and symptoms are not lessening within an hour, call for emergency help and/or transport the victim to the emergency room.

It is likely that a heat exhaustion victim will be unable to work for the remainder of the day.

Heat Stroke (a.k.a. Sun Stroke)

The signs and symptoms of heat stroke are skin that is hot and dry to the touch; flushing of the skin; body temperature > 105 degrees F; absence of sweating; mental confusion; deep, rapid breathing that sounds like snoring progressing to shallow, weak breathing; headache; dizziness; nausea; vomiting; weakness; dry mouth; convulsions, muscular twitching, sudden collapse; possible unconsciousness.

**First aid for heat stroke is as follows:**

1. Immediately remove the victim to the support area (before entering the support area, remove and dispose of the victim's chemical-resistant clothing).
2. Cool the victim rapidly using whatever means are available, including placing the victim in the shade, opening up and/or removing clothing, soaking clothing/skin with water and fanning, and placing the victim in vehicle using air conditioning on maximum.
3. Do not give drinking water to victim.
4. Treat for shock, if needed.
5. Transport the victim to the emergency room or call for emergency help; no exceptions for heat stroke victim.

Cold Stress

The potential for cold stress is a particular concern when field activities are performed while air temperatures at the site are below 40 degrees F. If winds are blowing at 5 miles per hour (mph) or greater and/or the weather is damp or wet, cold stress is even more of a potential hazard. Precautions that will be taken to prevent cold stress include wearing cold-protective clothing appropriate for the level of cold and physical activity, changing under clothing if it becomes wet, and establishing a work/warming regimen. Cold protective clothing will include layering of garments and use of gloves and hats. The warming breaks should be taken in a warm location if at all possible, including improvising a wind break shelter at the site. During warming breaks, warm sweet beverages and soups should be consumed to provide calories and fluids. Drinking coffee or other caffeinated beverages is not recommended.

Cold stress, if not prevented, can result in frostbite and hypothermia. Ignoring the signs and symptoms of cold stress can be life threatening. Prevention is the key. As a preventive measure, body core temperature must not drop below 96.8 degrees F. Pain in the

extremities is the first early warning of cold stress. Severe shivering sets in when the body core temperature has dropped to 95 degrees F or less. If this occurs, the affected worker(s) will stop work immediately and will take a warming break of sufficient duration that the cold stress signs and symptoms are gone.

# 4.0 PERSONNEL TRAINING REQUIREMENTS

## 4.1 TRAINING

Personnel working in a Exclusion Zone will have forty (40) hours of documented training pursuant to OSHA 29 CFR 1910.120(e). In addition, each individual as appropriate, will have received in the past year, eight (8) hours of documented annual refresher training. Supervisory personnel will also have received at least eight (8) additional hours of supervisory training. Documentation of classroom training and alternative training experience will be made available upon request by the Brown and Caldwell PM and/or SSO for contractors' personnel.

This site HASP will be made available prior to the start of subcontractors' field activities. A pre-operation meeting will be held to discuss the contents of the HASP. Specialty training will be provided as needed based on task and responsibility. All site-specific contractor training will be conducted under direct supervision of the Contractor Health and Safety Manager or their designee and training documentation provided for the Brown and Caldwell files.

## 4.2 TRAINING AND BRIEFING TOPICS FOR SITE ACTIVITIES

Pre-entry briefings shall be held by the SSO prior to initiating contractor site activity, at other times as necessary to ensure that employees are apprised of this HASP and as needed to ensure the HASP is being followed. Prior to beginning new site activities, all personnel will attend a task-specific Health and Safety orientation (a.k.a. tailgate meeting). The purposes of this orientation will be to familiarize project personnel with task-specific hazards, to ensure compliance with the HASP, and to fulfill Hazard Communication regulations. These topics will be discussed by the SSO during the work start-up orientation:

- Description of chemical and physical hazards
- Medical surveillance and training requirements

- Levels of protection, including respiratory protection, if required
- Site control measures and work zones
- Health and safety chain-of-command
- Hospital directions, emergency procedures, and telephone numbers
- Reporting of injuries and illnesses
- Brown and Caldwell's task-specific activities previously found in "Work Activities, Potential Hazards, and Control Measures" (Table 3-1).

Personnel performing sampling of or working around mercury will receive mercury awareness training, discussing the dangers of mercury and steps that can be taken to protect workers that will include:

- Possible routes of exposure to mercury
- The known health effects associated with exposure
- The importance of good personal hygiene
- The proper use and maintenance of protective clothing and equipment
- The correct use of engineering controls and implementation of good work practices

Personnel who will be working in the Exclusion Zone will attend the work start-up briefing and complete the previously noted "Acknowledgment" form (Attachment 1) attesting to their review of the HASP and attendance at the work start-up briefing. Additional training may occur on a daily basis relative to planned tasks and may also occur as events or circumstances arise that require revision of the HASP.

Exemptions from training are subject to the review and approval of the PM and/or SSO and will be noted in the site logbook.

## 5.0 PERSONAL PROTECTIVE EQUIPMENT TO BE USED

This HASP establishes minimum health and safety requirements for potential mercury and other chemical exposures to personnel at Brown and Caldwell. The requirements are consistent with the rules and regulations established by the Occupational Safety and Health Administration (OSHA). The principal objective of the program is to minimize exposure of Brown and Caldwell employees to mercury.

Standard work practices and engineering controls can be used to control hazards and exposure. For instance, particulate dust can be suppressed by utilizing water sprays or covering materials such as burlap. When the control procedures prove to be inadequate to ensure worker safety, appropriate personal protective equipment must be worn if exposures exceed the permissible exposure limits.

### 5.1 PERSONAL PROTECTION

Use of personal protective equipment (PPE) is a major means to minimize potential exposure. The levels of protection for personnel have been based on OSHA Guidelines for the compounds of concern, the U.S. Environmental Protection Agency (EPA) Occupational Health and Safety Manual, and the Hazardous Substances Data Bank of the National Library of Medicine.

Personnel working in the Exclusion Zone will have their own personal safety equipment and protective clothing, which will be used according to the direction of the SSO. Non-disposable PPE will be kept clean and maintained. Personnel will be trained in the use and maintenance of PPE and will be properly fitted prior to beginning site activities.

During activities which result in the potential need to upgrade to Level C (i.e., drilling or groundwater sampling), large mobile fans will be used to increase the air circulation through the breathing zone. Ideally, these fans will be positioned in the direction of the prevailing wind to assist/supplement the naturally occurring air exchanges and should be moved as required to continue to provide circulation. Air monitoring will continue in the breathing

zone as described in Section 7.0, Frequency and Types of Air Monitoring, to assess the effectiveness of the engineering control and to determine the appropriate level of PPE required (i.e. continuation in Modified Level D or upgrade to Level C with the continued use of fans).

Note, in the event that air monitoring indicates Level B PPE is warranted, then work will be stopped and additional engineering controls and monitoring will be implemented prior to work commencement. BC employees will not work in Level B conditions without authorization from the Regional Safety Unit Manager.

## 5.2 LEVELS OF PERSONAL PROTECTION EQUIPMENT

The levels of personal protection expected to be used are summarized in the revised Table 5-1. Modified Level D will be the minimum level of protection for personnel conducting activities within a Exclusion Zone; e.g., drilling activities. Level C will be the default level of protection for personnel working in areas where previous borings resulted in an upgrade to this level, and working in areas expected to be highly contaminated. The level of protection can be downgraded once monitoring during additional invasive activities has demonstrated that levels fall within the requirements for a lower level of personal protection. The SSO will determine which level of personal protection is required at all times.

### 5.2.1 Modified Level D

Modified Level D consists of:

- Hard hat
- Safety Glasses w/ splash protection
- Tyvek coveralls
- Nitrile gloves
- Safety Shoes w/ disposable boot covers

- ***NOTE***: Nitrile gloves and disposable boot covers are generally required only in areas where a significant potential for mercury exposure exists. The SSO will determine whether or not they are needed for a particular activity.
- ***NOTE***. Tape will be utilized to seal seams between protective suits, gloves, and shoe covers.

### 5.2.2 Level C

Level C defines the protection required when either of the following measurements are indicated: Note, quantitative fit test must be utilized on this project.

- Mercury vapor readings above 0.025 $mg/m^3$ and below 1.25 $mg/m^3$ in the breathing zone over a five-minute period.
- PID readings greater then 10 ppm and less than 100 ppm above background in the breathing zone over a five-minute period.

Level C consists of Modified Level D plus a full-face air-purifying respirators with combination organic vapor and mercury vapor cartridges, as appropriate. The end of service life for the mercury vapor cartridge is indicated by a color-change indicator. A buddy system will be used to monitor the end of service life of the mercury vapor cartridge since the individual using the cartridge is unable to see their own color-change indicator. No deviation from this level will be made without first contacting the PM and EUSM.

Odor threshold values are listed in Table 3-2. These values will be reviewed by the SSO to ensure that the odor threshold values of potential compounds are below the PEL standard as listed in Table 3-2. Unusual reports of odor should be investigated thoroughly. Exposure to compounds could occur if the odor threshold is higher than the PEL. If potential compounds have odor thresholds higher than the PELs, monitoring equipment must be relied upon to indicate airborne contaminants. Should monitoring equipment show ambient air levels above background, all personnel will evacuate until the PM and EUSM is contacted and provisions are made to enter the area with the use of respiratory protection.

## 5.3 CHEMICAL RESISTANCE/INTEGRITY OF PROTECTIVE MATERIAL

Generic clothing materials in Table 5-2 and in Table B-5 in Appendix B have been matched with various chemical classes that may be encountered during the performance of tasks covered under this HASP. Additional information regarding the integrity and limitations of personal protective equipment can be found in the publication *Quick Selection Guide to Chemical Protective Clothing* (1993). Should compounds be encountered on site that have not been identified by this HASP or are not printed within the Guide, the PM must be contacted.

## 5.4 INSPECTION OF PROTECTIVE EQUIPMENT

The proper inspection of PPE features several sequences of inspection depending upon the specific articles of PPE and frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing after receiving equipment from the factory, supplier, or distributor.
- Inspection of equipment when issued to workers.
- Inspection after use, training demonstrations, or following maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arises.

The primary inspection of PPE for activities will occur prior to immediate use and will be performed by the user so that the specific device or article has been checked out by the user, and the user is familiar with its use. Table 5-3 is a PPE Inspection Checklist that should be referenced before, during, and after use of personal protective equipment.

## 5.5 SPECIFIC LEVELS OF PROTECTION PLANNED FOR THE SITE

Modified Level D protection will be utilized during activities at the site unless air monitoring indicates a higher level of PPE is required (see Table 5-1). Personal protective equipment will be stored in a clean, dry area until it is used.

# 6.0 MEDICAL SURVEILLANCE REQUIREMENTS

## 6.1 MEDICAL SURVEILLANCE

Medical surveillance is conducted as a routine program for BC field staff in accordance with the requirements of 29 CFR 1910.120(f). There will not be any special medical tests or examinations required for staff involved in this project. If air monitoring indicates mercury levels beyond 1.25 mg/m3, or if employees exhibit symptoms of mercury exposure then mercury testing may be done.

## 6.2 EXPOSURE/INJURY/MEDICAL SUPPORT

Personnel covered by this HASP must report injuries and exposures and are encouraged to seek medical attention and physical testing following an injury or possible exposure above established exposure levels.

# 7.0 FREQUENCY AND TYPES OF AIR MONITORING

## 7.1 AIR MONITORING PURPOSE

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of personal protection required. Initial screening for identification is generally qualitative. Subsequent testing is typically required to quantify concentrations. Air monitoring will be used in Exclusion Zones to identify airborne contaminants using direct reading instruments, including:

- Jerome 431-X mercury vapor analyzer (MVA).
- Photoionization detector (PID) (HNu Model PI-101 or equivalent equipped with a 10.2 eV lamp).

The action levels for the PID and MVA as measured in the breathing zone, contained in Table 5-1 are as follows:

- Modified Level D
  - MVA < 0.025 mg/$m^3$
    AND
  - PID < 10 ppm above background

- Level C - with respirator and organic or mercury vapor cartridges, as appropriate
  - MVA > 0.025 mg/$m^3$ and < 1.25 mg/$m^3$
    OR
  - PID > 10 ppm and < 100 ppm above background.

  NOTE: Upon reaching the action level for Level C upgrade, engineering controls (large mobile fans as described in Section 5.1, Personal Protection) are to be implemented. Air monitoring will continue in the breathing zone to assess the effectiveness of the engineering control and to determine the appropriate level of PPE required (i.e. continuation in Modified Level D or upgrade to Level

C with the continued use of fans). In addition, a mercury clean-up agent like Mercon X may be utilized to assist in controlling vapors.

- Cease work
  - MVA > 1.25 mg/$m^3$ (full-face respirator with a quantitative fit test)
  - PID > 100 ppm
  - LEL > 25 ppm (when gasoline powered equipment is used inside of structures)

## 7.2 AIR MONITORING LOCATION AND FREQUENCY

Baseline

Conducting a downwind and an upwind sampling walk-around survey of the Exclusion Zone perimeter will accomplish baseline (background) monitoring. Background PID and MVA readings will be obtained once each morning after calibration and following lunch.

Breathing Zone

Prior to entering the Exclusion Zone, all field personnel will, at a minimum, utilize the level of protection outlined in this plan. Air monitoring using the PID and MVA will be conducted at each Exclusion Zone within the breathing zone to ensure that field personnel are not exposed to airborne contaminant concentrations in excess of action levels.

## 7.3 MONITORING OF ACTIVE WORK AREAS

During the period of active work in any Exclusion Zone, real time monitoring and indirect monitoring will be performed by the personnel present in each active work area as deemed necessary. Real-time measurements will be made as near as feasible to the breathing zone of the worker with the greatest exposure potential in each active work area. Any concentration above the action levels will be reported to the PM and action taken. As a minimum, real time measurements will be taken every fifteen minutes, or when task or exposure conditions

change (whichever frequency is less). All indirect sampling media will be analyzed by an AIHA (American Industrial Hygiene Association) accredited laboratory.

## 7.4 CALIBRATION OF MONITORING EQUIPMENT

Specification sheets for the monitoring equipment will be maintained within their shipping or storage containers. Included will be methods for calibration, operation, troubleshooting, and minor repair. Availability of the specification sheets will be monitored by the SSO. Deficiencies or operating problems with monitoring equipment will be made known to the PM. The continuous monitoring equipment will be serviced and batteries placed on charge, as they are required. Maintenance of monitoring equipment and major discrepancy or operating malfunction must be brought to the attention of the PM and/or SSO within 24 hours and will be entered into the field logbook.

# 8.0 SITE CONTROL MEASURES

## 8.1 WORK PRACTICES

Safe work practices are part of ensuring a safe and healthful working environment. These practices are standardized for all field activities, and it is the responsibility of BC employees to follow safe work practices when conducting field activities. Safe work practices to be employed during the entire progress of fieldwork are as follows:

- Site speed limit of 5 miles per hour is to be observed and maintained at all times.
- Personal vehicles are to remain on the paved site surfaces.
- Set up, assemble, and check out all equipment for integrity and proper function before starting work activities.
- Do not use faulty or suspect equipment.
- Use only new and intact protective clothing. Change the suit, gloves, etc., if they tear, leach or show signs of passing material across the protective boundary.
- Practice contamination avoidance at all times.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Do not smoke, eat, drink, or apply cosmetics while in the contaminated areas of the site, or before decontamination.
- Wash hands, face, and arms before taking rest breaks and lunch breaks and before leaving the site and at the end of the workday.
- Sign in and out with the GWTP operator upon arrival and departure from the site. The sign in sheet will be maintained in the GWTP.
- Perform decontamination procedures completely as required by this HASP.
- Notify the PM immediately if there is an accident that causes an injury or illness.
- Use the buddy system when working in the contaminated areas of the site. Phone calls to the office to provide status reports (i.e., on-site or off-site) fulfill the buddy system requirement.

- Do no approach or enter an area where oxygen deficiency or toxic or explosive concentrations of airborne contaminants may exist without the proper personal protective equipment and appropriate support personnel.
- Use respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-facepiece seal; do not wear contact lenses when the use of a respirator is required.

## 8.2 SITE SECURITY AND SITE ACCESS

Site Security is provided by chain-link fencing around the perimeter of the site. Access is limited by locked gates. Site personnel are to notify the local police in the event that an unauthorized person is observed on the site.

Exclusion Zones will be established at an approved protective distance (i.e., 50-foot radius) and indicated by one or more visible surface devices such as cones, tape, barriers, and/or fencing. The SSO will check the integrity of the secured areas throughout the workday. Planned activities requiring personnel access to a Exclusion Zone will be coordinated between ISP-ESI and the Brown and Caldwell SSO. Should access control be required during the nighttime hours, the SSO, through ISP-ESI, will arrange for security. Personnel entering the work zone are required to acknowledge reading the HASP previously noted as Attachment 1, and to adhere to the HASP requirements while in the vicinity.

Visitors to the site must provide their own National Institute of Occupational Safety and Health (NIOSH) approved safety equipment meeting the requirements of this HASP or they will be denied entry and access to the work site.

## 8.3 SITE COMMUNICATION

Successful communications between field teams and contact with personnel in the Support Zone is essential. The following communication systems will be available within Exclusion Zones:

- Normal verbal communication, which can include 2-way radios
- Hand signals for Level B and C are as follows:

| Signal | Definition |
|---|---|
| Hands clutching throat | Out of air / cannot breath |
| Hands on top of head | Need assistance |
| Thumbs up | OK / I am all right / I understand |
| Thumbs down | No / Negative |
| Arms waving upright | Send backup support |
| Grip partners wrist | Exit area immediately |

Brown and Caldwell personnel typically have access to a mobile cellular telephone that is present on site or carried in their vehicle.

## 8.4 DECONTAMINATION PROCEDURES

Decontamination is the physical process of removal of contaminants or potential contaminants from personnel and equipment before leaving the site. At this site, decontamination will primarily consist of the collection of materials into containers at decontamination stations established within Exclusion Zones designated by the SSO. Those items for disposal will be collected in a plastic-lined container and disposed of in a proper manner established by ISP-ESI Material Safety Data Sheets will be kept on site for chemicals used in the decontamination process.

Personnel involved in decontamination operations will be required to wear a splash-resistant coverall or apron, safety glasses, and rubber gloves for this task. Personnel decontamination will primarily consist of the removal of outer protective clothing and placement into containers. Following removal of outer protective clothing, personnel will be encouraged to shower as soon as possible and change into clean clothing.

The SSO will be notified in the event that non-disposable equipment becomes contaminated with mercury.

As part of the site decontamination process, potentially contaminated surfaces on vehicles and personnel within the Exclusion Zone that may track mercury (i.e., boots, tires, etc.), will need to be evaluated before leaving the site. The mercury vapor readings of these surfaces should not exceed 0.005 mg/$m^3$ when leaving the site except at the discretion of the SSO.

## 8.5 LEVELS OF DECONTAMINATION REQUIRED FOR PERSONNEL

Modified Level (D) PPE will typically be worn during site activities. Higher levels of protective clothing could be required depending on the results of air monitoring. A decontamination area will be established in each Exclusion Zone for both personnel and equipment. The Modified Level D decontamination procedure will be:

- Step 1 - Removal of outer boots if disposable

  **OR**: Scrub boots with a detergent solution (i.e., Alconox) and rinse with tap water, before taking them off.
- Step 2 - Removal of outer gloves.(If Applicable)
- Step 3 - Removal of Tyvek clothing.
- Step 4 - Removal of inner gloves.

***NOTE***: The use of outer gloves is not required under this HASP.

Should immediate medical attention be required to save a life, decontamination shall be delayed until the victim is stabilized. However, if decontamination can be performed without interfering with first aid or life saving techniques, or should a worker be contaminated with an extremely toxic or corrosive material that has the potential to cause severe injury or loss of life, decontamination must be performed immediately. If an emergency due to heat-related illness develops, protective clothing shall be removed from the individual to reduce heat stress. During an emergency, provisions shall also be made for

protecting medical personnel and disposing of contaminated clothing and equipment. Additional detailed decontamination information is contained in Appendix B.

# 9.0 EMERGENCY/DISASTER CONTINGENCY PLAN

## 9.1 PRE-EMERGENCY PLANNING

This section will be reviewed with project personnel along with the HASP before the project start-up in order to identify the potentially hazardous conditions that may be associated with specific task activities. The Emergency/Disaster Contingency Plan will be reviewed and revised as necessary by the SSO.

## 9.2 PERSONNEL ROLES AND LINES OF AUTHORITY

The SSO has the primary responsibility for coordinating response to emergencies on the project site. It is the responsibility of *anyone* observing an emergency situation to notify the SSO. In case the SSO cannot be reached immediately, the person observing the emergency can contact the appropriate emergency service (Table 9-1).

The SSO is responsible for reviewing the work to be performed on known or suspected mercury materials and evaluating the potential for mercury disturbance in compliance with the HASP. The SSO has the authority to audit compliance with the provisions of this procedure, suspend work or modify work practices for safety reasons, and to dismiss from work areas individual whose conduct endangers the health and safety of others.

## 9.3 MEDICAL ASSISTANCE/EMERGENCY CONTACTS

In the event of personnel exposure, accident, injury, or fire at the LCP Superfund Site facility, the following general accident and emergency response procedures are to be followed by personnel working under this HASP. The SSO should notify the PM and/or EUSM as soon as possible, and explain that an emergency incident has or is occurring. Individuals should contact the appropriate persons noted in Table 9-1.

Activities that may require outside responsive actions to mitigate an emergency situation shall be handled by the SSO.

## 9.4 MEDICAL EMERGENCY RESPONSE

The closest medical emergency center to the LCP Superfund Site is as follows:

**Robert Wood Johnson University Hospital at Rahway**
**865 Stone Street**
**Rahway, New Jersey 07065-2797**
**(732) 381-4200**

The directions to Rahway Hospital are shown on Figure 9-1 and are listed as follows:

- Head northwest from TREMLEY POINT RD (over the turnpike) towards SOUTH WOOD AVE
- Continue on SOUTH WOOD AVE
- Turn LEFT onto ROUTE 1 & 9 ( EAST EDGAR ROAD)
- Turn RIGHT at SOUTH STILES STREET (just past the John Russell Wheeler Park and before the General Motors Truck/Bus Plant)
- Continue on NORTH STILES SREET. Go 0.9 miles.
- Turn LEFT at WEST SAINT GEORGES AVENUE (ROUTE 27). Go 0.2 miles.
- Continue on SAINT GEORGES AVENUE (ROUTE 27). Go 1.2 miles.
- Turn RIGHT at STONE STREET. Go 0.2 miles.
- Arrive at ROBERT WOOD JOHNSON UNIVERSITY HOSPITAL

**Total estimated time to hospital: 12 minutes**

**Total distance: 5.0 miles**

## 9.5 EMERGENCY RECOGNITION AND PREVENTION

Section 3.0 provided a listing of chemical and physical hazards that may be encountered. Typical hazards as a direct result of site activities are listed in Table 9-2 with suggested

prevention and control techniques/mechanisms noted. Personnel working in Exclusion Zones will be familiar with the techniques of hazard recognition from preassignment training and from site-specific briefings.

## 9.6 EVACUATION ROUTES AND PROCEDURES

### 9.6.1 Work Area Evacuation

Should an emergency requiring evacuation occur, personnel will evacuate the area to a location pre-established by the SSO. These locations will be selected, marked and will be at upwind of the Exclusion Zone. Following the evacuation, the SSO will initiate a head count to check that personnel who entered the Exclusion Zone have successfully been evacuated.

In the event of an emergency which necessitates an evacuation of the Exclusion Zone, the following alarm procedure will be implemented:

- Three loud horn blasts - personnel will be expected to proceed to the designated evacuation area and will remain in the area until a re-entry to the Exclusion Zone is authorized.

### 9.6.2 Facility Evacuation

Evacuation of the facility may be required in the event of severe weather including flooding, hurricane, electrical storms, or during neighboring plant evacuation requirements. In the event that the normal route from the plant out to and including South Wood Avenue is inaccessible, the LIMAC route will be used. The LIMAC route allows for evacuation of personnel from the area along the marked route through the various plants in the tremley point area. ISP-ESI personnel will notify LCP site workers if site evacuation is necessary due to surrounding site conditions and can assist workers at LCP if evacuation is needed due to conditions at LCP.

## 9.7 INCIDENT REPORTING

Following an accident or incident, an incident report will be completed by a responsible individual at the scene (refer to Incident/Accident Report, Attachment 6). Information in the incident report will include the following items:

- Name(s) of individuals involved or witnesses
- Date and time
- Exact location
- Description of incident
- Type of exposure suspected or nature of injury
- Nature of emergency response actions
- Corrective measures taken to prevent repeat of the incident

Incident reports will be filed with the ISP-ESI Project Manager and Brown and Caldwell's PM and EUSM as soon as practical and a written report filed within 24 hours of the incident.

Further, in the event of a hazardous material spill or chemical release above the reportable quantity, the appropriate Federal and State agencies will be notified. Notification will be made from the SSO to the ISP-ESI Project Manager who in turn shall report the incident to the appropriate regulatory agency.

## 9.8 EMERGENCY MEDICAL TREATMENT PROCEDURES

At least one individual present on the site must have current First Aid and Cardio-Pulmonary Resuscitation (CPR) training. Personnel with minor injuries can be treated on site. In the event of a serious injury, the person will be stabilized and the Linden Fire Department will be called on to transport them. All accidents must be reported to the Project Health and Safety Manager.

An individual who becomes ill or is injured while working within the Exclusion Zone must be decontaminated to the maximum extent possible. Should the injury or illness be minor in nature, a full decontamination of personnel will be administered prior to transport to a medical facility. If the individual's condition is serious, a quick decontamination of the person should be completed (i.e., complete clothing removal and redressing in clean overalls or wrap the individual in a blanket). First aid should be administered while awaiting an ambulance or trained medical personnel. Injuries and illnesses will be reported immediately as described in Section 9.2. A vehicle used to transport contaminated or potentially contaminated personnel will be decontaminated as necessary.

Should an accident occur where an employee rendering first aid is exposed to blood, contact the PM and/or SSO immediately to report the incident, as required under the OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030).

## 9.9 FIRE OR EXPLOSION

In the event of a fire or explosion, the Linden Fire Department should be notified immediately by calling (9-1-1). In addition the PM and LCP Superfund Site Project Contact should be notified immediately.

## 9.10 SPILLS AND LEAKS

Personnel will report spills or leaks to the SSO and the ISP-ESI Site Contact. Should a spill or leak occur which is a threat to human health or a release to environment (air, water or soil), the person observing the spill will:

- Evacuate or request an evacuation of persons at risk.
- Inform ISP-ESI Site Contact supervisor and/or SSO immediately.
- Locate the source of the spillage and stop the flow if it can be done safely.
- If safe to do so, begin containment and recovery of the spilled materials utilizing appropriate response methodology and PPE.

## 9.11 EMERGENCY EQUIPMENT AND FACILITIES

The following equipment will be available on this site:

- First aid kit
- Fire extinguisher
- Portable eye wash
- Emergency water supply (10 gallon minimum) for emergency drenching

# TABLES

**TABLE 1-1**

**LIST OF WORK ACTIVITIES FOR BROWN AND CALDWELL PERSONNEL AT THE LCP CHEMICALS, INC. SUPERFUND SITE LINDEN, NJ**

1. Concrete Drilling

2. Surficial Soil Samples

3. Soil Borings

4. Monitoring Well Installation

5. Monitoring Well Decommissioning

6. Sediment Sampling

7. Surface Water Sampling

8. Biological Sampling

9. Tide Investigation

10. Groundwater Sample Collection

11. Hydraulic Conductivity Tests

12. Site Storage Tank Survey

13. Site Building Reconnaissance

14. Fence Installation

**TABLE 3-1**

**WORK ACTIVITIES, POTENTIAL HAZARDS, AND CONTROL MEASURES**
**LCP Chemicals Inc. Superfund Site, Linden, New Jersey**

| OPERATOR TASK | POTENTIAL HAZARDS | PROTECTIVE MEASURES |
|---|---|---|
| Concrete Drilling | Inhalation of or direct contact with contaminants; noise; injury from rubber tire back-hoe or other equipment; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris |
| Well Drilling/Installation Surficial Soil Samples/Soil Borings | Inhalation of or direct contact with contaminants; noise; injury from drilling rig or other equipment; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris |
| Monitoring Well Decommissioning | Inhalation of or direct contact with contaminants; noise; injury from drilling rig or other equipment; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris |
| Sediment and Surface Water Sampling | Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris |
| Biological Sampling | Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls | Modified Level D PPE with waders as required; air monitoring; heat/cold stress training; removal of debris |
| Tide Investigation | Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris |
| Groundwater sampling | Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris |
| Hydraulic Conductivity Tests | Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris |

**TABLE 3-1 (CONTINUED)**

**WORK ACTIVITIES, POTENTIAL HAZARDS, AND CONTROL MEASURES**
**LCP Chemicals Inc. Superfund Site, Linden, New Jersey**

| OPERATOR TASK | POTENTIAL HAZARDS | PROTECTIVE MEASURES |
|---|---|---|
| Site Storage Tank Survey (exterior of tanks) | Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris |
| Survey Location Site Reconnaissance | Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris |
| Fence Construction | Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls | Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris |

Any physical entrance into vaults or manholes by *any* personnel qualifies as a confined space entry. Such entry shall follow confined space entry procedures which include the use of trained personnel, air monitoring, and established rescue procedures. Entry into these areas by Brown and Caldwell employees are *not authorized* nor anticipated under this HASP.

# Table 3-2

## Constituents of Interest and Occupational Exposure Limits
## LCP Superfund Site

| Constituent | IP[a] | TLV[c] 8-hour TWA | PEL[d] 8-hour TWA | IDLH[e] Level | Odor Threshold, PPM | Notes[f] | Potential Symptoms of Exposure[g] |
|---|---|---|---|---|---|---|---|
| Mercury | NA | 0.025 mg/m$^3$ | 0.1 mg/m$^3$ | 10 mg/m$^3$ | NA | | Eye and skin irritation, chest pain, dyspnea, headache, fatigue, irritability |
| Polychlorinated Biphenyls | NA | 0.5 mg/m$^3$ | 1 mg/m$^3$ | 5 mg/m$^3$ | | Ca, S, 65 | Nausea, lethargy, chloracne, dermal lesions, dec. pulmonary function, hepatic injury |
| Benzene | 9.24 | 0.5 ppm | 1 PPM | 500 PPM | 4.68 | Ca, 65 | Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression |
| Chlorobenzene | 9.07 | 10 ppm | 75 PPM | 1000 PPM | | | Irritation to skin, eyes, nose, drowsiness, incoherence |
| 1,2 Dichlorobenzene | 9.06 | 25 ppm | 50 ppm C | 200 ppm | <15 ppm | | Eye and nose irritant, liver and kidney damage, skin blisters |
| 1,3 Dichlorobenzene | 9.12 | NA | NA | Unknown | | | Irritates the eyes, the skin and the respiratory tract. |
| 1,4 Dichlorobenzene | 8.98 | 10 ppm | 75 ppm | Ca | 0.12 | 65, Ca | Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting |
| Naphthalene | 8.12 | 10 ppm | 50 mg/m$^3$ | 250 ppm | | | Eye irritation, excitement, vomiting, dematitis |
| Carbon Monoxide | 14.01 | 25 ppm | 50 ppm | 1200 ppm | | C | Headache, rapid breathing, nausea, weakness, eye and throat irritation, increased heart rate, dizziness, confusion. |

[a] Ionization potential in electron-volts (eV).

[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1999.

[d] Permissible Exposure as the airborne 8-hour time-weighted average (TWA) established by the Occupational Safety and Health Administration (OSHA).

[e] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.

[f] Hazard category; Ca-Carcinogen; C-Ceiling; S-Skin absorption; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.

[g] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of Poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merck Index, 1996.

**TABLE 3-3**

**MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES**
**29 CFR 1910.120 (M). Table H-102.1**

| Foot-Candles | Area or Operation |
|---|---|
| 5 | General site areas |
| 3 | Excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas. |
| 5 | Indoors: warehouses, corridors, hallways, and exit ways |
| 5 | Tunnels, shafts, and general underground work areas. |
| 10 | General shops (mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms) |
| 30 | First aid stations, infirmaries, and offices. |

**TABLE 3-4**

**COMPARISON OF HEAT STROKE AND HEAT EXHAUSTION**

| | Heat Stroke (911 - Medical Emergency) | Heat Exhaustion |
|---|---|---|
| **Definition:** | A condition or derangement of the heat-control centers due to exposure to the rays of the sun or very high temperatures. Loss of heat is inadequate or absent. | A state of very definite weakness produced by the excess loss of normal fluids and sodium chloride in the form of sweat. |
| **History:** | Exposure to sun or extreme heat | Exposure to heat; person usually works indoors |
| **Differential Symptoms:** | *Face*: Red, dry, and hot<br>*Skin*: Hot, dry, and no sweating<br>*Temperature*: High, 106° to 110°F (41.1° to 43.3°C)<br>*Pulse*: Full, strong, bounding<br>*Respirations*: Audible, labored, difficult, loud<br>*Muscles*: Tense and possible convulsions<br>*Eyes*: Pupils are dilated, but equal | *Face*: Pale, cool, and moist<br>*Skin*: Cool, clammy, with profuse sweating<br>*Temperature*: Subnormal<br>*Pulse*: Weak, thready, and rapid<br>*Respirations*: Shallow and quiet<br>*Muscles*: Tense and contracted<br>*Eyes*: Pupils are normal; eyeballs may be soft |
| **Treatment:** | Absolute rest with head elevated; keep body cool by any means available until hospitalized, but do not use alcohol applied to skin. Take temperature every 10 minutes, and do not allow it to fall below 101°F (38.5°C).<br>*Drugs*: Allow no stimulants; give infusions of normal saline (to force fluids). | Keep patient quiet; head should be lowered; keep body warm to prevent onset of shock.<br>*Drugs*: Salty fluids and fruit juices should be given frequently in small amounts. Intravenous isotonic saline will be required if patient is unconscious. |

Source: *Taber's Cyclopedic Medical Dictionary*, 17th Edition, 1993.

**TABLE 5-1**

**ACTION LEVELS FOR UPGRADING PERSONAL PROTECTIVE EQUIPMENT**

| Level | Level Application |
|---|---|
| **MODIFIED LEVEL D**<br>• Work uniform with long pants<br>• Tyvek® coveralls[a]<br>• Latex Gloves[b]<br>• Steel toe boots w/ disposable boot covers[b]<br>• Safety glasses with side shields<br>• Hard hat and hearing protection as required<br>• Breathing zone air monitoring with a PID (10.2 eV lamp) and a mercury vapor analyzer (MVA). | • Breathing zone PID reading less than 10 ppm for more than five minutes.<br>AND<br>• Breathing zone MVA less than 0.025 mg/m$^3$ for more than five minutes. |
| **LEVEL C**<br>Modified Level D plus:<br>• Tyvek® coveralls with hood[a]<br>• Full face respirators equipped with cartridges for organic gases and vapors or mercury vapors, as appropriate.<br>• Breathing zone air monitoring with a PID (10.2 eV lamp) and a mercury vapor analyzer (MVA). | • Breathing zone PID readings greater than 10 ppm and less than 100 ppm for more than five minutes.<br>OR<br>• Breathing zone MVA readings above 0.025 mg/m$^3$ and less than 1.25 mg/m$^3$ over for more than five minutes.<br>Note: These values are only good with quantitative respirator fit test. |
| **LEVEL B**<br>**Note: Work will be stopped and exclusion zone exited prior to deciding Level B. No BC employee will don Level B without prior approval by RSUM.**<br>• Level C skin, face, head and foot protection plus an air-supplied respirator (air supplied or self-contained breathing apparatus with a qualitative fit test).<br>• Approval and oversight from the H&S Staff is required for this Level of Protection on BC projects. | • Breathing zone PID readings in excess of 100 ppm for more than five minutes.<br>OR<br>• Breathing zone MVA readings in excess of 1.25 mg/m$^3$ for more than five minutes. |

**TABLE 5-1**

**ACTION LEVELS FOR UPGRADING PERSONAL PROTECTIVE EQUIPMENT**

| Level | Level Application |
|---|---|
| **CEASE WORK** | • Breathing zone PID readings in excess of 100 ppm for more than five minutes<br>OR<br>• MVA readings in excess of 1.25 mg/m$^3$ for more than 5 minutes (air supplied respirator with a qualitative fit test).<br>• Breathing zone Carbon Monoxide (CO) measurements in excess of 25 ppm when gasoline powered equipment is used inside of structures in excess of fine minutes. |

Notes:

a Tyvek® coveralls to be used during specified sampling or drilling operations. Cotton gloves and undergarments are recommended to be worn to provide for perspiration absorption which serves as a cooling device for the body.

b Nitrile gloves and shoe covers are required in areas where a potential for mercury exposure exists.

**TABLE 5-2**

**CHEMICAL PROTECTION OF CLOTHING MATERIALS BY GENERIC CLASS**
**And**
**GLOVE MATERIALS - COMPARATIVE CHEMICAL RESISTANCE**

| CHEMICAL PROTECTION OF CLOTHING MATERIALS | | | | |
|---|---|---|---|---|
| Generic Class | Butyl Rubber | Polyvinyl Chloride | Neoprene | Natural Rubber |
| Alcohols | E | E | E | E |
| Aldehydes | E-G | G-F | E-G | E-F |
| Amines | E-F | G-F | E-G | G-F |
| Esters | G-F | P | G | F-P |
| Ethers | G-F | G | E-G | G-F |
| Fuels | F-P | G-P | E-G | F-P |
| Halogenated Hydrocarbons | G-P | G-P | G-F | F-P |
| Hydrocarbons | F-P | F | G-F | F-P |
| Inorganic Acids | G-F | E | E-G | F-P |
| Inorganic Bases and Salts | E | E | E | E |
| Ketones | E | P | G-F | E-F |
| Natural Fats and Oils | G-F | G | E-G | G-F |
| Organic Acids | E | E | E | E |

Legend: E – Excellent
G – Good
F – Fair
P – Poor

Source: Survey of Personnel Protective Clothing and Respiratory Apparata, September 1974, DOT, USCG, Office of Research and Development

| GLOVE MATERIALS - COMPARATIVE CHEMICAL RESISTANCE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl | Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
| Acetaldehyde | E | G | G | E | Cyanide | G | G | G | G |
| Acetate | G | F | P | G | Cyclohexane | G | F | G | F |
| Acetic acid | E | E | E | E | Cyclohexanol | G | F | E | G |
| Acetone | G | E | P | E | Cyclohexanone | G | E | F | G |
| Acetylene gas | E | E | E | E | Decaborane | F | P | F | F |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Acetylene tetrachloride | F | NR | F | F |
| Acrylonitrile | G | F | F | G |
| Amidol | G | E | F | E |
| Amine hardeners | F | F | G | G |
| Ammonium hydroxide | E | E | E | E |
| Amyl acetate | F | P | P | F |
| Amyl alcohol | E | E | E | E |
| Anhydrous ammonia | G | E | E | E |
| Aniline | G | F | P | F |
| Aniline hydrochloride | F | G | P | F |
| Aniline oil | F | G | P | F |
| Animal fats | E | P | E | G |
| Animal oils | E | F | E | G |
| Anodex | G | E | -- | E |
| Anthracene | F | P | F | P |
| Aromatic fuels | P | NR | F | NR |
| Arsine | E | E | E | E |
| Asbestos | E | E | E | E |
| Asphalt | G | F | E | F |
| Banana oil | F | P | P | F |
| Benzaldehyde | F | F | G | G |
| Benzene | P | NR | F | NR |
| Benzol | P | NR | F | NR |
| Benzyl alcohol | E | E | E | E |
| Benzyl benzoate | G | F | G | F |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Degreasing fluids | F | P | G | P |
| Diacetone alcohol | E | E | E | E |
| Diborane | F | P | F | F |
| Dibenzyl ether | G | G | F | G |
| Dibutyle phthalate | G | P | G | G |
| Dichloroethane | P | NR | F | NR |
| Dichloropropene | P | P | F | F |
| Diesel fuel | G | P | E | P |
| Diethanolamine | E | G | E | E |
| Diethylamine | E | G | E | G |
| Diethyltriamine | G | F | E | G |
| Diisobutyl ketone | P | F | P | G |
| Diisocyanate | G | P | G | E |
| Dimethyl formamide | F | F | G | G |
| Dioctyl phthalate | G | P | E | F |
| Dioxane | E | G | G | G |
| Emulsifying agent | G | F | E | E |
| Emulthogene | G | F | G | E |
| Epichlorohydrin | G | P | F | G |
| Epoxy resins, dry | E | E | E | E |
| Esters | F | P | P | F |
| Ethane gas | E | G | E | E |
| Ethanol | E | E | E | E |
| Ethers | E | G | G | G |
| Ethyl acetate | G | F | F | G |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Benzyl chloride | F | P | F | G |
| Biacosolve | G | P | G | P |
| Boron tribromide | G | P | P | P |
| Bromine | G | P | P | P |
| Bromoform | G | P | P | P |
| Butane | E | F | E | F |
| 2-Butanone | G | G | F | G |
| Butyl acetate | G | F | P | F |
| Butyl alcohol | E | E | E | E |
| Butylaldehyde | G | G | E | G |
| Butylene | E | G | E | G |
| Cadmium oxide fume | E | E | E | E |
| Calcium hydroxide | E | E | E | E |
| Carbolic acid | E | E | F | E |
| Carbon dioxide | E | E | E | E |
| Carbon disulfide | F | F | F | F |
| Carbon tetrachloride | F | P | G | P |
| Castor oil | F | P | E | F |
| Cellosolve | F | G | G | G |
| Cellosolve acetate | G | F | G | G |
| Chlordane | G | F | G | F |
| Chlorine | G | F | F | G |
| Chlorine gas | G | F | F | G |
| Chlorobenzene | F | P | P | F |
| Chloroacetone | F | F | P | E |
| Chlorobromomethane | F | P | F | P |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Ethyl alcohol | E | E | E | E |
| Ethyl bromide | -- | -- | P | -- |
| Ethyl ether | E | G | G | E |
| Ethyl cutyl ketone | -- | -- | P | -- |
| Ethyl formate | G | F | G | G |
| Ethylaniline | F | F | P | G |
| Ethylenediamine | E | G | E | G |
| Ethylene dichloride | F | P | P | F |
| Ethylene gas | E | G | E | E |
| Ethylene glycol | E | E | E | E |
| Ethylene oxide | G | F | G | -- |
| Ethylene trichloride | F | P | G | P |
| Fatty acids | E | P | E | F |
| Ferrocyanide | F | G | G | E |
| Fluoric acid | E | G | E | E |
| Fluorine | G | F | F | G |
| Flourine gas | G | F | F | G |
| Formaldehyde | E | E | E | E |
| Formic acid | E | E | E | E |
| Freon 11 | G | P | G | F |
| Freon 12 | G | P | G | F |
| Freon 21 | G | P | G | F |
| Freon 22 | G | P | G | F |
| Furfural | G | G | G | G |
| Gasoline, leaded | G | P | E | F |
| Gasoline, unleaded | G | P | E | F |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Chloroform | G | P | E | P |
| Chloronaphthalene | F | P | F | F |
| Chlorophenylene diamine | G | P | F | F |
| Chloropicrin | P | P | P | F |
| Chloroethene | P | NR | F | NR |
| Chromic acid | F | P | F | F |
| Chromotex | G | G | G | G |
| Citric acid | E | E | E | E |
| Cool tar pitch volatiles | F | P | F | -- |
| Cottonseed oil | G | G | E | F |
| Cotton dust (raw) | E | E | E | E |
| Creosote | G | G | F | G |
| Cresol | G | G | F | G |
| Cupric nitrate | G | G | E | E |
| Hydrogen gas | E | E | E | E |
| Hydrogen peroxide 30% | G | G | G | G |
| Hydrofluosilicic acid | F | G | G | G |
| Hydroquinone | G | G | F | G |
| Inorganic salts | E | E | E | E |
| Iodine | G | F | G | G |
| Isooctane | F | P | E | P |
| Isopropanol | E | E | E | E |
| Isopropyl alcohol | E | E | E | E |
| Kerosene | E | F | E | F |
| Glycerine | E | E | E | E |
| Glycerol | E | E | E | E |
| Glycol | E | E | E | E |
| Gold fluoride | G | E | E | E |
| Grain alcohol | E | E | E | E |
| Halogens | G | F | F | G |
| Hexamethylenetetramine | F | G | F | G |
| Hexane | F | P | G | P |
| Hexyl acetate | F | P | P | F |
| Hydraulic oil | -- | -- | -- | -- |
| ester base | E | P | F | G |
| petroleum base | G | P | E | P |
| Hydrazine | F | G | G | G |
| Hydrochloric acid | E | G | G | G |
| Hydrofluoric acid | E | G | G | G |
| Phenylenediamine | G | P | G | G |
| Phenythydrazine | G | G | G | G |
| Phil. solv | E | F | E | G |
| Phosphoric acid | E | G | E | E |
| Pickling solution | G | G | G | E |
| Picric acid | E | G | E | G |
| Pine oil | E | P | E | F |
| Pitch | E | P | E | F |
| Plating solutions | E | E | E | E |
| Potassium alum | G | G | G | E |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Ketones | G | E | P | E |
| Lacquer thinner | G | F | P | F |
| Lactic acid | E | E | E | E |
| Lauric acid | E | F | E | E |
| Lineoleic acid | E | P | E | F |
| Linseed oil | E | P | E | F |
| Maleic acid | E | E | E | E |
| Mercuric chloride | G | E | G | E |
| Mercury | G | G | G | E |
| Methane gas | E | E | E | E |
| Methanol | E | E | E | E |
| Methyl acetate | G | F | P | G |
| Methyl alcohol | E | E | E | E |
| Methylamine | F | F | G | G |
| Methyl bromide | G | F | F | G |
| Methyl cellosolve | G | G | G | G |
| Methyl chloride | NR | NR | NR | NR |
| Methyl ethyl ketone | G | G | NR | E |
| Methyl formate | G | F | F | G |
| Methylene bromide | G | G | F | G |
| Methylene chloride | G | F | F | G |
| Methyl isobutyl ketone | F | F | P | E |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Potassium bromide | G | G | G | E |
| Potassium chrome alum | G | G | G | E |
| Potassium dichromate | F | F | F | E |
| Potassium terrocyanide | G | G | G | E |
| Potassium hydroxide | E | E | E | E |
| Printing inks | E | G | G | G |
| Propane gas | E | E | E | E |
| Propanol (iso) | E | E | E | E |
| Propyl acetate | G | F | F | G |
| Propyl alcohol | E | E | E | E |
| Propyl alcohol (iso) | E | E | E | E |
| Propylene gas | E | F | E | E |
| Propyne gas | E | F | E | E |
| Pyrethrum | E | E | E | E |
| Red fuming nitric acid | P | P | P | P |
| Rhodium fume and dust | E | E | E | E |
| Silver nitrate | E | G | E | E |
| Skydrol 500 | P | G | P | G |
| Sodium carbonate metal | G | G | G | E |
| Sodium hydroxide | E | E | E | E |
| Sodium sulfite | G | G | E | E |
| Sodium thiosulfide | G | G | E | E |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Methyl methacrylate | G | G | F | E |
| Mineral oils | E | F | E | F |
| Monochlorobenzene | F | P | P | F |
| Monoethanolamine | E | G | E | E |
| Morpholine | E | E | G | E |
| Muriatic acid | E | G | G | E |
| Naphthalene | G | F | G | F |
| Naphthas, aliphatic | E | F | E | F |
| Naphthas, aromatic | G | P | G | P |
| Nitric acid | G | F | F | F |
| Nitric acid, red and white fuming | -- P | -- P | -- P | -- P |
| Nitrobenzene | F | P | F | F |
| Nitroethane | F | P | F | F |
| Nitrogen gas | E | E | E | E |
| Nitromethane | F | P | F | F |
| Nitropropane | F | P | F | F |
| Nitrous oxide | G | G | G | G |
| Octyl alcohol | E | E | E | E |
| Oleic acid | E | F | E | G |
| Oxalic acid | E | E | E | E |
| Oxygen, liquid | F | P | NR | F |
| Ozone | G | P | P | G |
| Paint thinners | G | F | G | F |
| Paint and varnish removers | G | F | F | F |
| Solvarsol | E | F | E | F |
| Solvessos | P | P | G | P |
| Stearic acid | E | E | E | E |
| Stoddard solvent | E | F | E | G |
| Styrene | P | P | F | P |
| Styrene 100% | P | P | F | P |
| Sulfuric acid | G | G | G | G |
| Tannic acid | E | E | E | E |
| Tetrahydroborane | F | P | F | F |
| Tetraethyl lead | E | F | E | G |
| Tetrahydrofuran | P | F | F | F |
| Toluene | F | P | F | NR |
| Toluene diisocyanate | F | G | F | G |
| Toluol | F | P | F | NR |
| Trichlor | F | P | G | P |
| Trichloroethane | F | F | G | P |
| Trichloroethylene | P | P | F | P |
| Tricresyl phosphate | G | F | E | F |
| Tridecyl alcohol | G | F | E | F |
| Triethanolamine | E | G | E | G |
| Trinitrotoluene | G | P | G | F |
| Trinitralolual | G | P | G | F |
| Tripiane | E | P | E | F |
| Tung oil | E | P | E | F |
| Turca No. 2998 | P | P | - | F |

| Chemical | Neo-prene | Natural Latex or Rubber | Milled Nitrile | Butyl |
|---|---|---|---|---|
| Palmitic acid | E | E | E | E |
| Paradichlorobenzene | E | F | E | E |
| Parathion | P | F | F | F |
| Pentaborane | F | P | F | F |
| Pentachlorophenol | F | G | G | G |
| Pentane | E | G | E | G |
| Perchloric acid | E | F | G | G |
| Perchloroethylene | F | NR | G | NR |
| Perklene | E | NR | G | NR |
| Permachlor | E | F | E | NR |
| Petroleum distillates (naphtha) | G<br>-- | P<br>-- | E<br>-- | -<br>-- |
| Petroleum spirits | E | F | E | F |
| Phenol | E | F | F | G |
| Turpentine | G | F | E | F |
| Unsymmetrical Dimethylhydrazine | --<br>F | --<br>P | --<br>F | --<br>P |
| Varnoline gas | E | F | E | F |
| Vanadium fume and dust | E | E | E | E |
| Varsol | G | F | G | F |
| Vegetable oils | E | G | E | G |
| Wood alcohol | E | E | E | E |
| Wood preservatives | G | F | G | G |
| Woodyouth | F | P | F | G |
| Xylene | P | P | F | P |
| Xylol | P | P | F | P |
| Xylidene | E | F | F | F |
| Zinc chloride | E | E | E | E |

Legend: E – Excellent
G – Good
F – Fair
P – Poor

**TABLE 5-3**

**SAMPLE PPE INSPECTION CHECKLISTS**

**CLOTHING**

**Before Use:**

- Determine that the clothing material is correct for the specified task at hand.
- Visually inspect for:
  - imperfect seams
  - non-uniform coatings
  - tears
  - malfunctioning closures
- Hold up to the light and check for pinholes.
- Flex product:
  - observe cracks
  - observe for other signs of shelf deterioration
- If the product has been used previously, inspect inside and out for signs of chemical attack:
  - discoloration
  - swelling
  - stiffness

**During the work task, periodically inspect for:**

- Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind however, that chemical permeation can occur without any visible effects.
- Closure failure
- Tears
- Punctures
- Seam discontinuities

**GLOVES**

**Before Use:**

- Visually inspect for:
  - imperfect seams
  - tears, abrasions
  - non-uniform coating
  - pressurize glove with air; listen for pin-hole leaks

**BOOT COVERS**

**Before Use:**

- Visually inspect for:
  - imperfect seams
  - tears
  - missing or ripped elastic band
  - insects, snakes, spiders, etc. that may have crawled into PPE

**FULL-FACE RESPIRATOR INSPECTION**

**Before Use:**

- Visually inspect for:
  - proper size
  - proper cartridges
  - cleanliness
  - exhalation valves
  - inhalation valves
  - facepiece cracks, splits
  - gasket for cartridge seal
  - deformities in facepiece
  - integrity of straps
- Perform positive and negative pressure fit test every time respirator is worn

**TABLE 9-1**

**EMERGENCY CONTACT PHONE LIST**
**LCP Chemicals Inc. Superfund Site, Linden, NJ**

**KEEP AVAILABLE AT ALL TIMES**

The following is a reference list of project contacts:

| | |
|---|---|
| Client: | ISP-ESI<br>1361 Alps Road<br>Wayne, NJ 07470 |
| | |
| Client Contact: | Dave McNichol<br>(973) 628-3355 - office<br>(973) 445-4524 – mobile<br>dmcnichol@ispcorp.com |
| | |
| Client Site Contact: | John Vandersteen<br>(908) 474-5102 - office<br>(908) 296-2412 - mobile |
| | |
| BC Project Principal: | Jeffrey Caputi<br>(201) 574-4700 ext 4742 - office<br>(201) 819-4330 - mobile<br>jcaputi@brwncald.com |
| | |
| BC Project Manager: | Scott MacMillin<br>(201) 574-4700 ext. 4711 - office<br>(201) 841-0350 - mobile<br>smacmillin@brwncald.com |
| | |
| BC Ecology Task Manager: | Tamara Sorell<br>(201) 574-4700 ext. 4758 - office<br>(973) 519-5359 - mobile<br>tsorell@brwncald.com |
| | |
| Eastern Unit Safety Manager: | Lydia M. Crabtree<br>(615) 250-1236 - office<br>(615) 202-1311 - mobile<br>lcrabtree@brwncald.com |
| | |
| Project Geologist/SSO: | Matt Cavas<br>(201) 574-4700 ext. 4746 - office<br>(201) 213-8712 - mobile<br>mcavas@brwncald.com |
| | |
| Project Biologist/SSO: | Femke Hartog<br>(201) 574-4700 ext. 4701 - office<br>(646) 415-3701 - mobile<br>fhartog@brwncald.com |

| | |
|---|---|
| | |
| Alternate SSO: | Brian Snyder<br>(201) 574-4700 ext. 4750 - office<br>(201) 669-9959 - mobile<br>bsnyder@brwncald.com |
| | |
| Alternate SSO: | Thakur Chaturgan<br>(201) 574-4700 ext. 4752 - office<br>(201) 841-1801 - mobile<br>tchaturgan@brwncald.com |
| | |
| Field Personnel: | Courtney Lia<br>(201) 574-4700 ext. 4706 - office<br>(201) 669-1060 - mobile<br>clia@brwncald.com |

The following emergency telephone numbers will be used to call for assistance:

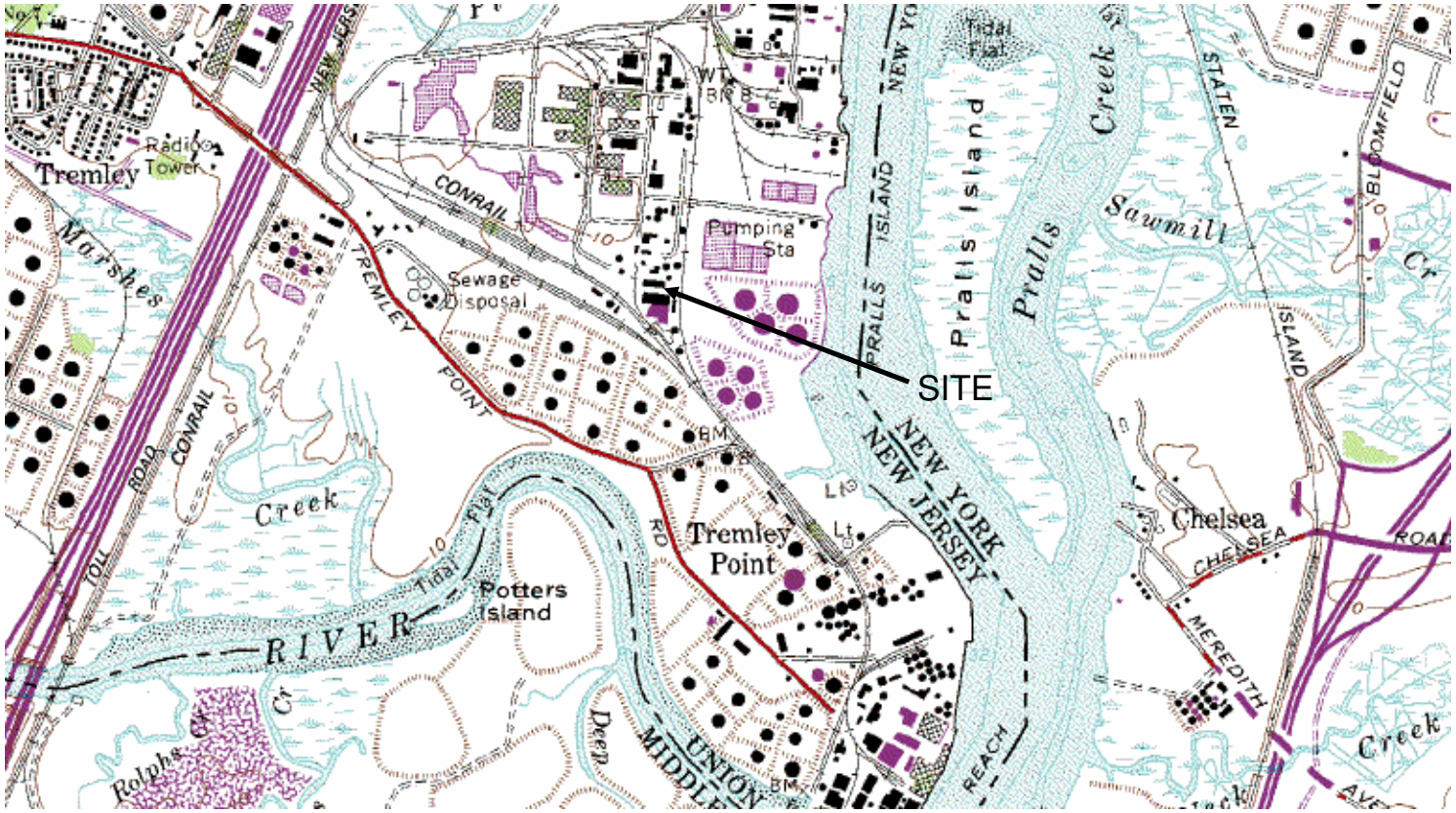
| | | |
|---|---|---|
| **Local Hospital:** | Robert Wood Johnson University Hospital at Rahway | 732-381-4200 |
| **Emergency Care:** | Police (Non-emergency) | 908-474-8500 |
| | Police | 9-1-1 |
| | Ambulance | 9-1-1 |
| | Fire | 9-1-1 |

**TABLE 9-2**

**EMERGENCY RECOGNITION AND CONTROL MEASURES**

| Hazard | Specific Condition Location | Prevention Control |
|---|---|---|
| Fire/Explosion | Borehole; wellhead; gasoline fueled equipment | Fire/safety inspections; Alarm system; Fire extinguisher; Evacuation routes |
| Air Release | Wellhead; seal opening with on site material | Water spray; foam; Alarm system; Evacuation routes |
| Spill | Drill cuttings; groundwater; DECON solvents and contaminated water/residues; well head; DECON station; staging area | Berms and dikes; Sorbent materials; Alarm system; Evacuation routes |

# FIGURES



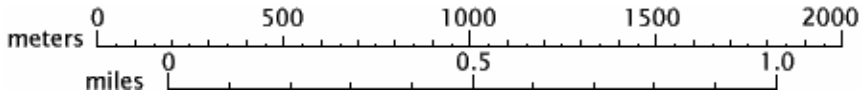



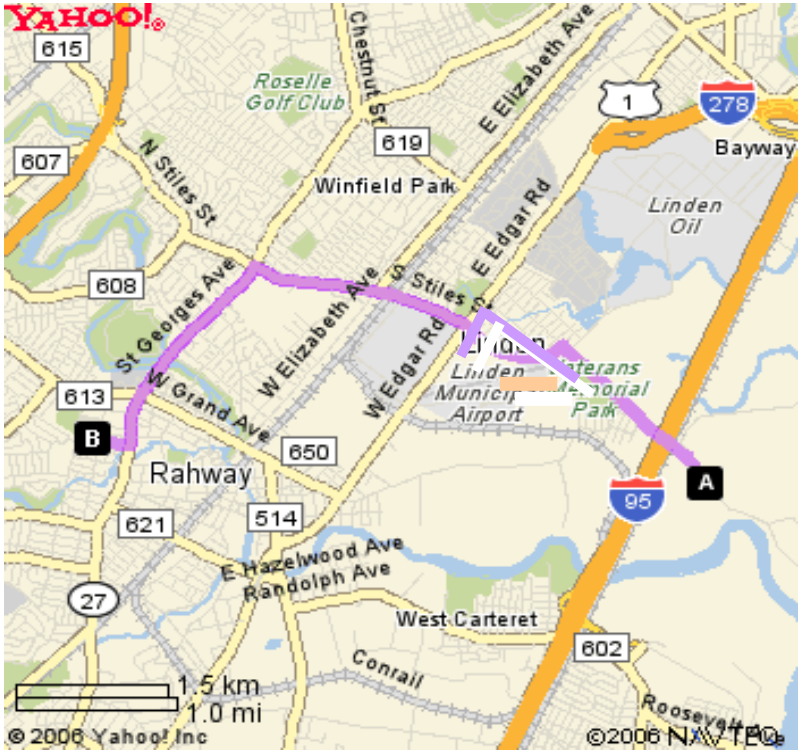

FIGURE 1-1

## SITE LOCATION MAP

LCP CHEMICALS INC. SUPERFUND SITE
LINDEN, NEW JERSEY

BROWN AND CALDWELL

P:\^Clients\LCP\127806(Pre-Ph_II_RI)\HASP_Ph_II_RI\Figures\F1-1_082506_(Site_Location_Map).ppt




The directions to Rahway Hospital are as follows:

•Head northwest from TREMLEY POINT RD (over the turnpike) towards SOUTH WOOD AVE

•Continue on SOUTH WOOD AVE

•Turn LEFT onto ROUTE 1 & 9 ( EAST EDGAR ROAD)

•Turn RIGHT at SOUTH STILES STREET (just past the John Russell Wheeler Park and before the General Motors Truck/Bus Plant)

•Continue on NORTH STILES SREET. Go 0.9 miles.

•Turn LEFT at WEST SAINT GEORGES AVENUE (ROUTE 27). Go 0.2 miles.

•Continue on SAINT GEORGES AVENUE (ROUTE 27). Go 1.2 miles.

•Turn RIGHT at STONE STREET. Go 0.2 miles.

•Arrive at ROBERT WOOD JOHNSON UNIVERSITY HOSPITAL


**Robert Wood Johnson University Hospital at Rahway**
**865 Stone Street**
**Rahway, New Jersey 07065-2797**
**(732) 381-4200**

FIGURE 9-1

ROUTE TO HOSPITAL

LCP CHEMICALS INC. SUPERFUND SITE
LINDEN, NEW JERSEY

BROWN AND CALDWELL

P:\^Clients\LCP\127806(Pre-Ph_II_RI)\HASP_Ph_II_RI\Figures\F9-1_082506_(Hospital_Route).ppt

R2-0000802

# APPENDIX A

# PROCEDURES FOR FIELD OPERATION OF PID AND MVA

# *JEROME®*
# 431-X™
## MERCURY VAPOR ANALYZER

# OPERATION MANUAL

September, 2000

Arizona Instrument LLC
1912 West 4th Street
Tempe, AZ 85281

(602)470-1414
800-528-7411
Fax(480)804-0656
http://www.azic.com

SS-086, Rev D

# *JEROME* 431-X

## Mercury Vapor Analyzer

# Operation Manual

# TABLE OF CONTENTS

# FOR THOSE WHO CAN'T WAIT TO USE YOUR JEROME 431-X BEFORE READING THIS MANUAL

**CAUTION:** The Jerome 431-X is intended for vapor use only. **DO NOT** allow the probe or the instrument's intake to come in contact with liquids, dust or other foreign material.

Please read the manual for added details that will optimize the results and the life of your instrument or if your application requires use of dosimeters, special voltage inputs or data output. Also, refer to the manual for complete details on operation, maintenance and troubleshooting.

The Jerome 431-X is easy to operate and ready for use upon receipt from the factory. Follow these brief steps to use your instrument.

- Remove the instrument from the packing material. Check for any damage and confirm receipt of all parts on your packing list. Contact Arizona Instrument Customer Service at 800-528-7411 or 602-470-1414 if you have any questions.
- Press the ON button. In less than one second the display should read 000. Note that a LO BATT message appears briefly in the upper left corner. If the LO BATT light persists, charge the battery. See page 13 for details.
- Check the voltage setting (110 or 220 VAC) on the back of the instrument. Ensure that it is set to the correct voltage. If the voltage must be changed, turn the knob. However, it may also be necessary to change the frequency setting; see page 18 for details.
- Perform a sensor regeneration by following these steps:
  - ➢ Plug the line cord into the instrument using the plug in the back and to an AC power outlet.
  - ➢ Power the instrument ON and press the REGEN button. The instrument will begin a 10 minute regeneration cycle, indicated by .H.H.H flashing on the display. **Do not interrupt this cycle.** For a complete description of this process, see page 10.
  - ➢ If any error message, such as .H.L.P or .L.L.L appears on the display, see the Troubleshooting section on page 20.
- Adjust the sensor zero by pressing the ZERO button and turning the zero adjust screw located under the handle. Adjust until the display reads 0.
- The instrument is now ready to sample. Note that as the instrument measures mercury, the ZERO will display H. **Do not adjust the ZERO after the instrument has measured mercury and before the next regeneration.** (Occasionally the ZERO may drop to L (for low) between the initial zeroing and the first sample. It is OK to readjust the ZERO if the instrument has not measured mercury.)
- The instrument is designed for work space air monitoring. Press the SAMPLE button to start a 12 second sampling cycle.
- **DO NOT allow the probe or the instrument's intake to come in contact with liquids.**
- **Note that the instrument is not explosion proof.**
- After the day's survey, again perform a sensor regeneration. When complete, store the instrument with the zero air filter in the intake.

**If you have any questions call AZI Customer Service, or your Technical Sales Representative, at 1-800-528-7411 or 1-602-470-1414**

# 2 INTRODUCTION

The Jerome 431-X Gold Film Mercury Vapor Analyzer is designed for the easy and accurate analysis of mercury vapor in the workplace environment and for the location of mercury spills. The 431-X is easy to operate and has few maintenance requirements however, please take a moment to read this manual before attempting operation.

The Jerome 431-X is an ambient air analyzer with a range of 0.001 to 0.999 milligrams per cubic meter ($mg/m^3$ Hg). If you have any questions about your application or operation, please call AZI Customer Service at 800-528-7411 or 602-470-1414 for assistance.

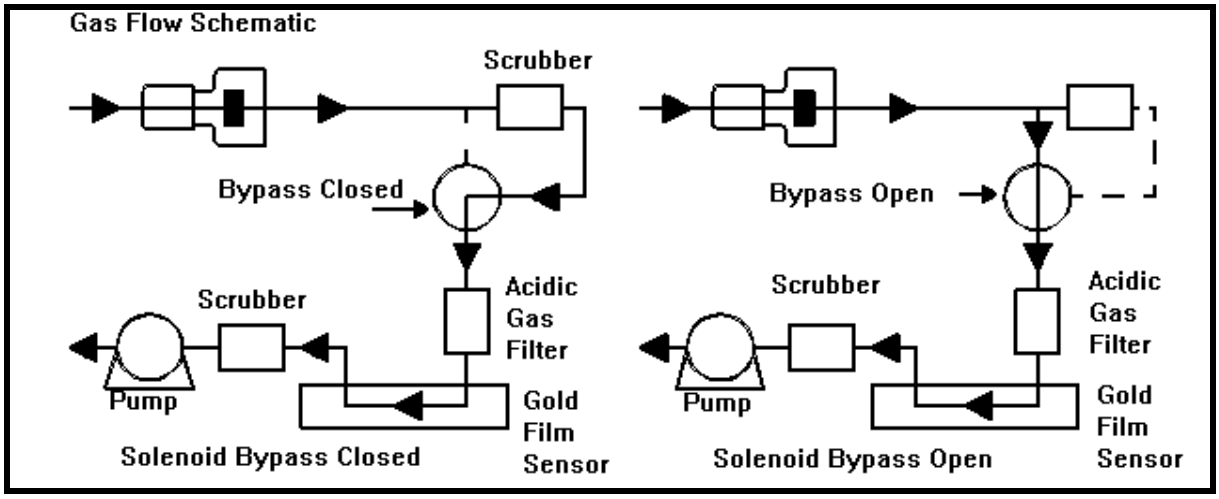

## 2.1 Features of the 431-X

- Automatic sensor regeneration when equipped with the communications option and used with the Jerome Communication Interface Software (JCI) program and the Jerome data logger.
- Regulated film heat voltage during sensor regeneration. This allows the sensor to clean properly with voltages from 100-130 VAC (or 200-260 VAC).
- Survey mode can be locked in.
- DIP switch setting can change the digital meter readings from $mg/m^3$ Hg to nanograms (ng) of Hg (see page 18).
- The Jerome 431-X can be operated from 100-130 or 200-260 VAC. To change the default voltage range, refer to Setting the Input Voltage, page 18.

# 3 PRINCIPLES OF OPERATION

Mercury is unique in its ability to alter the resistance of a gold film. The 431-X sensor consists of two thin gold films, a reference and a sensor, configured in a Wheatstone Bridge Circuit, which detects very small changes in electrical resistance. The reference film is sealed and not exposed to mercury. The sensor film is exposed to mercury resulting in resistance changes, which are measured by the circuit. A microprocessor computes the concentration and displays the results.

Activating the SAMPLE mode starts an internal pump which draws air through a scrubber filter and into the flow system. After 2 seconds, the sample solenoid bypass opens, closing off the scrubber filter from the flow system. The sample air passes through a filter (removing any acidic gases which interfere with the sensor's response to mercury) and is drawn over the gold film sensor. The sensor adsorbs and integrates the mercury vapor. Nine seconds after starting, the sample solenoid bypass closes and the remainder of the sample is drawn through the scrubber filter and the flow system. The measured concentration is then displayed on the digital meter in milligrams per cubic meter ($mg/m^3$) of mercury. An internal DIP switch can be used to change the digital meter display from $mg/m^3$ to nanograms of mercury (see page 18).




The instrument's microprocessor automatically rezeroes the digital meter at the start of each sample cycle and retains the meter reading until the next sample cycle begins, thus eliminating drift between samples.

During the sample cycle, bars on the digital meter represent the percentage of sensor saturation. Approximately sixty-five samples containing 0.1 $mg/m^3$ Hg may be taken before the sensor reaches saturation. After absorbing approximately 500 nanograms of mercury, the sensor becomes saturated and needs to be cleaned. This is accomplished by a manually activated 10 minute heat cycle, or sensor regeneration which burns the mercury from the sensor. This mercury is absorbed on internal filters to prevent any external contamination. The solenoid bypass closes during the sensor regeneration cycle, causing the air to pass through the scrubber filter, providing clean air for the regeneration process. The flow system's final scrubber prevents contamination to the atmosphere from the desorbed mercury.

After a sensor regeneration, it is necessary to bring the two gold films back to a similar resistance. The ZERO button, along with the ZERO ADJUST potentiometer, are used to reset the sensor's reference film and sensor film to the same baseline. The sensor may exhibit some low level thermal drift after the regeneration cycle, due to heat generated during sensor regeneration. To ensure maximum sample accuracy, wait 30 minutes after a regeneration and then check the ZERO adjustment. If the display reads 0 when the ZERO button is pressed, the adjustment has been accomplished. If the display reads H or L, simply turn the ZERO ADJUST pot with the trimmer tool or small screwdriver to complete the adjustment.

**Only adjust the ZERO pot after a regeneration.** It is not necessary to rezero between samples since the instrument automatically erases the previous reading. If the ZERO ADJUST pot is manually turned between samples, the results will be slightly lower than the actual concentration. However, this is not a permanent problem and is corrected with a sensor regeneration.

# 4 INSTRUMENT OPERATION

## 4.1 Digital Meter Display Codes

| METER DISPLAY | EXPLANATION |
|---|---|
| 000 | Ready to sample |
| .000 | Lack of mercury reading |
| 00.0 | Lack of mercury reading, display in nanograms (see page 18) |
| .8.8.8 | Perform sensor regeneration (refer to page 10) |
| .H.H.H | Sensor regeneration in progress (.H.H.H flashes) |
| .L.L.L | Perform re-zero (refer to page 10) |
| .P.P.P | Power cord required or low line power, <100 VAC (or 200 VAC)(see page 19, Changing the Fuse, if .P.P.P remains on after the cord is connected.) |
| .H.L.P | High line power, greater than 130 VAC (or 260 VAC) |
| .LO BAT | Recharge batteries (refer to page 13) |
| .E.E.E | Same as LO BAT, automatically shuts off |
| .HL | High level, sample exceeded maximum sample limit (.999) |
| **DURING SAMPLING** | |
| .- | 0-25% sensor saturation |
| .-- | 25-50% sensor saturation |
| .--- | 50-75% sensor saturation |
| -.--- | 75-100% sensor saturation |

| DURING SAMPLING | USING THE SURVEY MODE |
|---|---|
| - | Survey sampling (minus sign flashes continuously) |
| **WHEN ZERO IS DEPRESSED** | Adjust to 0 only after sensor regeneration. It is normal for the display to read H after sampling has started. |
| 0 | Zero, ready to sample |
| H | High, turn Zero pot counterclockwise |
| L | Low, turn Zero pot clockwise |

## 4.2 Daily Operations

Before each day's use of the Jerome 431-X, perform the following four steps to verify proper instrument operation:


- Press the power ON button.
  - ➢ The digital meter displays 000. (Disregard the digital meter's initial momentary reading.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.
  - ➢ To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.
- Perform a sensor regeneration. Refer to page 10 for the procedure. Thirty minutes after sensor regeneration is complete, rezero the instrument.

NOTE: For maximum accuracy, such as when testing with the Functional Test Kit, wait thirty minutes after the sensor regeneration cycle to rezero the unit. For emergency response, such as for spill cleanup, the unit can be rezeroed immediately after sensor regeneration

- Press the SAMPLE button.
  - ➢ During the sample cycle, the digital meter displays a bar (-) which indicates the amount of sensor saturation.
- At the end of the 12 second cycle, read the digital meter.
  - ➢ The number shown on the digital meter is the mercury concentration in $mg/m^3$. This value remains on the display until the next sample is taken. The digital meter automatically zeroes at the start of each sample.
- At the end of each day's use perform a sensor regeneration. **DO NOT ALLOW MERCURY CONTAMINATION TO STAY ON THE GOLD FILM SENSOR OVERNIGHT.**

## 4.3 Sensor Regeneration Instructions

A sensor regeneration is needed to clear the 431-X sensor of any accumulated mercury and to prolong the life of the sensor. This simple procedure should be done:

- At the beginning of the day on which the instrument is to be used.
- During the mercury survey, if the sensor becomes saturated.
- At the end of the day's survey, before storage.
- At a minium of every 30 days while the instrument is in storage. Regeneration once each month will prolong the life of the gold film sensor.

See the Principles section on page 7 for more details on the gold film sensor and the sensor regeneration.

AC power must be between 100-130 VAC or 200-260 VAC for the sensor to clean properly. If AC power is not between these limits, an .P.P.P or .H.L.P may appear in the display (see page 8). Refer to page 18 for voltage and frequency settings.

**CAUTION:** Once a sensor regeneration is initiated, **DO NOT** interrupt the cycle.

- Attach the power cord to the 431-X and plug it into AC power. AC power is required to thermally regenerate the sensor.
- Press the power ON button.
- Press the REGEN button.
  - ➢ The digital meter flashes .H.H.H for the duration of the 10 minute cycle and displays .0.0.0 when the cycle is completed.
  - ➢ DO NOT INTERRUPT THIS CYCLE. Wait until the cycle is completed before continuing with the next step.

NOTE: The digital meter will read .P.P.P after REGEN is activated if the power cord is not plugged in or if the instrument's fuse needs replacing. Plug in the power cord, or if necessary, replace the fuse according to the procedure on page 19.

- While pressing the ZERO button, turn the ZERO ADJUST potentiometer using the trimmer tool until the digital meter reads 0. See the illustration on page 6 for the location of the ZERO ADJUST potentiometer.
  - ➢ If the meter reads H, turn the ZERO ADJUST counter-clockwise;
  - ➢ If the meter reads L, turn the ZERO ADJUST clockwise.

NOTE: A minimum 30 minute wait after the sensor regeneration cycle is complete ensures maximum sample accuracy. However, the unit can be used immediately following the sensor regeneration if necessary. When the sensor regeneration is complete, press ZERO and adjust the ZERO ADJUST pot until 0 appears on the display. Install the zero air filter in the intake and take several samples or lock the instrument into survey mode (see page 12). After approximately one minute, stop sampling and check the ZERO. Adjust to 0. Repeat sampling through the zero air filter until sensor remains on 0.

NOTE: Depending upon internal configuration, a number between 00 and 100 may appear on the display, instead of H, L, or O when zero is pressed. See Internal Dip Switch Settings, page 18, for details. **IMPORTANT: Do not turn the ZERO ADJUST potentiometer between samples.** Turn the ZERO ADJUST only after a sensor regeneration cycle otherwise invalid readings will result.

- Press the power OFF button and disconnect the power cord.
- The Jerome 431-X is ready for sampling.

## 4.4 Sample Mode

This mode, used for standard operation, produces optimum accuracy (+/-5% at 0.100 mg/m$^3$ Hg) with the Jerome 431-X.

- Press the power ON button.
  ➢ The digital meter displays 000. If the unit is set to display in ng, the digital meter displays 00.0. (Disregard the digital meter's initial momentary readings.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.

- To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.

- Press the SAMPLE button.
  ➢ During the sampling cycle, the bar (or bars) shown on the digital display indicate the current percentage of sensor saturation. (Refer to Meter Display Codes, page 8, for code descriptions.)
  ➢ The bar (or bars) flash after 2 seconds and again after an additional 7 seconds. This flashing signals the opening and closing of the solenoid sample bypass. (See the Principles of Operation on page 7 for details.)

- At the end of the 12 second cycle, read the digital meter.
  ➢ The number shown on the digital meter is the mercury concentration in mg/m$^3$ (or ng). This value remains displayed until the next sample is taken. The digital meter automatically zeroes at the start of each sample.

- When the sensor is completely saturated, the digital meter displays .8.8.8 instead of a value. No further operation is possible until a sensor regeneration is performed. (Refer to page 10 for the Sensor Regeneration procedure.)

- Press the power OFF button when not in use. Install the zero air filter in the instrument intake during storage.

## 4.5 Sampling Notes

- The Jerome 431-X is intended for vapor use only. **DO NOT** allow the probe or the instrument's intake to come in contact with liquids, dust or other foreign material. Moisture or liquids drawn into the instrument can damage the sensor and flow system.
- The Jerome 431-X operates a minimum of 6 hours on a fully charged battery.
- Use the probe (AZI P/N1400-2002) to locate mercury vapor in hard to reach places. Plug the probe directly into the instrument's intake.

## 4.6 Survey Mode

The survey mode takes samples every 3 seconds automatically. Use this mode to locate mercury spills or to assess areas of potentially high mercury concentrations. Sampling in the survey mode is not as accurate. Due to the decreased sample volume, the accuracy of the instrument is reduced to +/- 20% @ .100 mg/m$^3$.

- Press the power ON button.
  - ➢ The digital meter displays 000. If the unit is set to display in ng, the digital meter displays 00.0. (Disregard the digital meter's initial momentary readings.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.
  - ➢ To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.

- Press and **hold** the SAMPLE button.
  - ➢ The instrument takes a normal 12 second sample, displays the concentration at the end of the cycle and then goes into the survey mode sampling every 3 seconds. The display flashes the measured concentrations at the end of each 3 second sample cycle.

- When you are finished surveying, **release** the SAMPLE button.
  - ➢ The final survey value remains displayed until the next sample is taken.

NOTE: Approximately 65 samples at .1 mg/m$^3$ may be taken before a sensor regeneration is required.

- **To lock the instrument in a survey mode**:
  - ➢ Hold the SAMPLE button down until the sensor status indicator bar(s) "_" begins flashing on the display.
  - ➢ Press the ZERO button, then release the SAMPLE button.
  - ➢ The pump should continue to run and the display should update every 3 seconds.
  - ➢ The instrument remains in the survey mode until one of the following occurs:
    - ➤ The sensor is saturated
    - ➤ A LO BAT (low battery) signal is encountered
    - ➤ An HL (high mercury level) is encountered
    - ➤ The instrument is turned OFF.

- Press the power OFF button when not in use.

## 4.7 Operating on AC Power or Generator

For stationary use, the 431-X may be operated on AC power. Operating the instrument only on AC power eliminates the need for the battery pack and its necessary maintenance. If preferred, the battery may be unplugged or removed completely.

When using a generator to power the Jerome 431-X, it is important that the generator is capable of maintaining a constant voltage output. **This is especially true during the sensor regeneration.** Use a high quality line conditioner or voltage regulator to prevent damage to the electronic components and the sensitive gold film sensor.

## 4.8 Operating on Internal Battery Power

Battery power allows use of the Jerome 431-X as a portable instrument. If battery power is necessary for use, please be aware of the following:

- A fully charged battery pack (AZI P/N Z4000-0907) provides power for a minimum of 6 hours of operation.
- For operating more than 6 hours, an extra fully charged battery pack is needed.
- Complete battery recharging takes 14 hours. Refer to page 13, Charging Batteries for instructions if needed.
- The 431-X use a rechargeable NiCad battery. Dispose of the old battery properly when it is replaced with a new one.
- **External battery power:** A special version of the Jerome 431-X is available that can be operated from a secondary DC source, such as a battery used in conjunction with solar panels. Contact AZI for additional information.

## 4.9 Charging Batteries

- Press the power OFF button.
- Attach the power cord to the 431-X and plug it into AC power.
- *Complete battery recharging takes 14 hours.*
- *The 431-X contains a trickle charger so it may be continually plugged into an AC power source without damaging the battery pack.*

NOTE: To charge the batteries outside of the instrument, use the IDC Battery Charger (AZI P/N 4000-1011, for 115 VAC, P/N 4000-1012, for 230 VAC).

## 4.10 Obtaining Maximum Battery Life

There are certain inherent limitations to NiCad (Nickel Cadmium) batteries. The primary limitation is a memory effect that occurs when the batteries are partially discharged and then recharged, repeatedly. This memory leads to a drastic reduction in the usable battery life. To prevent this memory effect, periodically allow the battery pack to discharge completely, then recharge the battery pack.

- For maximum battery life, follow these 3 steps:
  - ➢ At least once a month wait until LO BAT appears on the digital meter before recharging the battery pack.
  - ➢ Charge the battery pack when the LO BAT indicator comes on. Excessive discharge can damage the battery pack. Before storing the instrument verify the power is OFF.

- When batteries fail to hold a charge, the battery pack should be replaced. Battery life under normal usage is approximately 1 year, depending on the number of charge and discharge cycles.

# 5 MAINTENANCE

## 5.1 Preventive Maintenance Calendar

To keep the Jerome 431-X operating at peak performance, follow the maintenance schedule below. Use this schedule as a guideline only, as maintenance is more a function of application and amount of use, rather than time.

**ALWAYS install the zero air filter into the instrument's intake during storage.**

| PART/COMPONENT | MAINTENANCE CYCLE | PAGE |
|---|---|---|
| Charge batteries | At least once per month, after one month's storage, or when LO BAT appears | 13 |
| Change .25mm fritware | Weekly or as needed | 15 |
| Change internal filters* | After 6 months of use or as needed. | 16 |
| Replace zero air filter* | Annually | 16 |
| Factory calibration | Annually | 19 |
| Calibration check | Monthly or as needed | 29 |
| Replace batteries | Annually or as needed<br>The battery pack contains NiCad batteries. Dispose of them properly. | 17 |

* C/M filters contain Mallcosorb™, Scrubber filters and zero air filters contain Resisorb™. For safety information, see the supplier's Material Safety Data Sheets (MSDS) or call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining the MSDS. Dispose of all filters properly.

## 5.2 Flow System

The Jerome 431-X's flow system is the crucial link between the sensor and the sample. For the instrument to perform correctly, the flow system must be properly maintained. The user maintainable components of this system are the intake filter (.25 mm fritware), a C/M filter, two scrubber filters and connecting tubing.

Check the Preventive Maintenance Calendar, page 14, for a suggested schedule for changing filter disc and filters. The Tygon™ tubing in the system must be free of crimps for proper flow.

- Replace the .25mm Fritware once each week. In dusty environments, the fritware may need replacement as often as once a day. Replacement .25mm Fritware are available from AZI, Technical Sales, 1-800-528-7411 or 1-602-470-1414, (see Accessories & Maintenance Parts on page 25).
  - ➢ Unscrew and remove the intake from the instrument.
  - ➢ Push the old fritware disc out using your trimmer tool.
  - ➢ Use tweezers to insert the new fritware. Avoid touching the new fritware disc with fingers.
  - ➢ Use the blunt end of the trimmer tool to seat the fritware disc firmly against the inner ledge of the intake.
  - ➢ Screw the intake back on the instrument.

**Figure 4 Remove Intake**

**Figure 6 Remove Fritware**

**Figure 5 Insert Fritware**

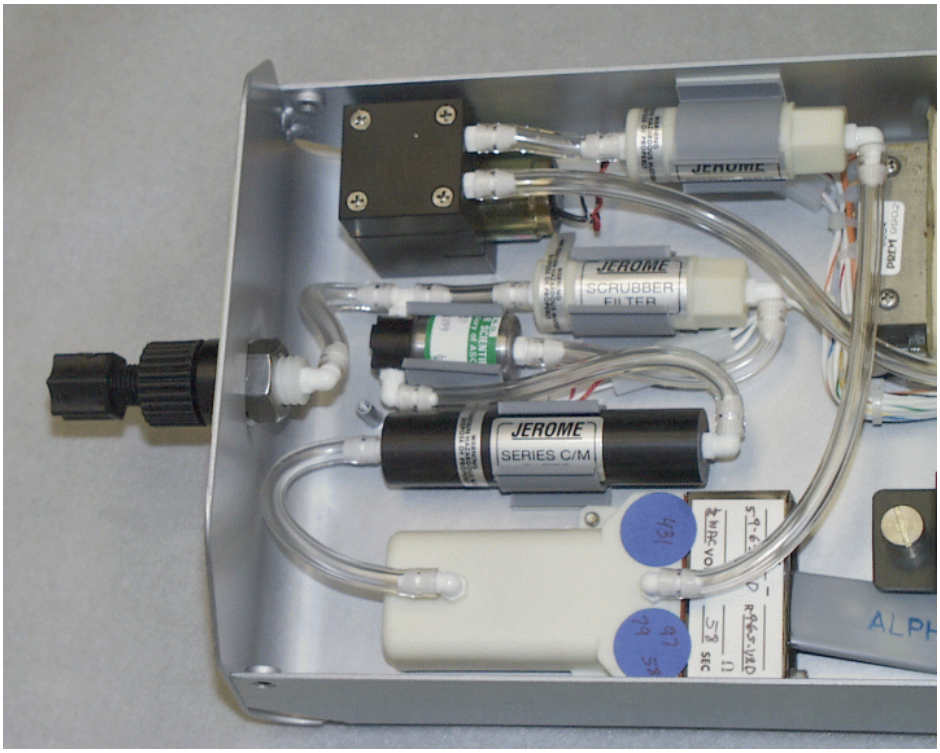
**CAUTION**

The air flow intake, on the front of the instrument, must be securely held in place. If it is loose, the tubing inside the instrument can become twisted when the intake housing is replaced. On older instruments, it may be necessary to open the instrument and tighten the retaining nuts from the inside. Call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 if you have any questions.

## 5.3 Internal Filters

Replace the internal filters system (one C/M filter and two scrubber filters) after six (6) months of use, or as needed. (See Troubleshooting section, page 20.)

- Press the power OFF button and unplug the power cord.
- Remove the 2 side screws from the intake end of the instrument and open the case.
- Carefully disconnect the Tygon™ tubing from both ends of the filters and discard the old filters.




CAUTION:

The Series C/M filter contains Mallcosorb™ and the Scrubber Filters contain Resisorb™. Both types contain trace amounts of mercury. For safety information, see the supplier's Material Safety Data Sheets (MSDS) or call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining the MSDS. Use proper disposal methods for all filters.

- Connect the new filters to the Tygon™ tubing, ensuring all filter straight nipples point toward the intake and elbows point according to the illustration.
  ➢ Push the Tygon™ as far as it will go onto the filter fittings.
- Push the filters into the mounting clips.
- Remove any crimps in the tubing and ensure that tubing connections are secure.
- Close the case and replace the screws.
- Dispose of all filters in accordance with State and Federal EPA Regulations.

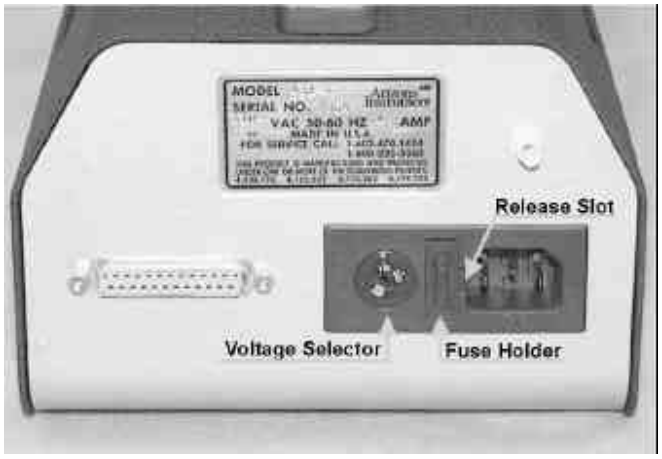
## 5.4 Replacing Battery Pack

- Press the power OFF button.
- Unplug the power cord.
- Remove the screws, one on each side, from the intake end of the instrument and open the case lid.
- Disconnect the battery connector from the board.
- Loosen the two (2) captive screws holding the battery bracket and remove the bracket.
- Remove the old battery pack and replace it with a new battery pack.
- Replace the battery bracket and tighten the captive screws.
- Connect the new battery connector to the board.
- Close the case and replace the screws.
- Dispose of the old NiCad battery properly, in accordance with State and Federal EPA Regulations.

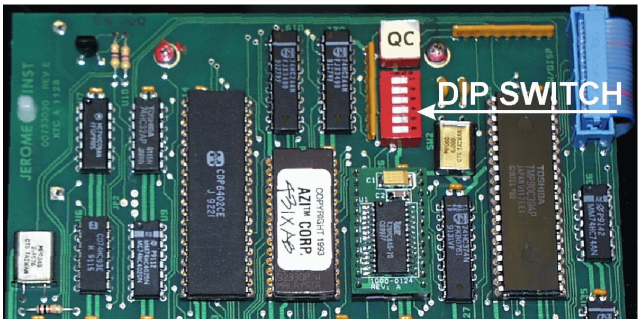
# 6 INTERNAL DIP SWITCH SETTINGS

## 6.1 Input Voltage and Frequency

This instrument has been factory set and calibrated to use the input power setting, either 110 VAC, 60 Hz, or 220 VAC, 50 Hz, requested when the instrument was ordered. The settings are easily changed using the switch in the Power Inlet Module for voltage and the internal DIP switch setting for frequency.




- Ensure the instrument is turned OFF and unplugged.
- Locate the power receptacle on the rear of the instrument.
- Insert a small screwdriver in the voltage selection slot and turn the selector until the arrow points toward your setting choice and a click is heard.
- Turn the instrument off.
- Remove the two screws near the front of the instrument and open the lid.
- Locate DIP Switch SW2 at the top of the main circuit board. See figure at right.
- Set DIP Switch SW2 position #1 and #6 as follows.




| | 60Hz | 50Hz |
|---|---|---|
| Position #1 | OFF | OFF |
| Position #6 | OFF | ON |

## 6.2 Displaying Nanograms or Milligrams/Cubic Meter

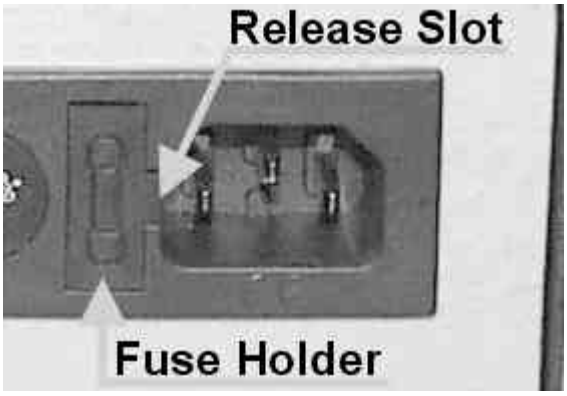
The instrument is factory set to display mg/m$^3$ (milligrams per cubic meter) Hg (.XXX). For some applications, including dosimeter analysis, the instrument's display can be converted to display nanograms.

- Turn the instrument off. Remove the two screws near the front of the instrument and open the lid.
- Locate DIP Switch SW2 at the top of the main circuit board. See figure above.
- Place position #2 to OFF for Nanogram display.
- Return position #2 to ON for Milligram display.

## 6.3 Changing the Fuse

If the instrument display reads .P.P.P when the instrument is connected to AC power or when REGEN is pressed, or if the battery will not charge, the fuse may need to be replaced. The AC line power could also be less than 100 VAC (220 VAC). Check the fuse with an ohm meter and/or the AC line power with a voltage meter.

- Locate the power receptacle on the rear of the instrument.
- Insert a small screwdriver in the slot and gently slide the fuse compartment out.
- Check the fuse held in the open sided clip and if it is bad, replace it with the spare fuse held in the sliding spare fuse compartment. Discard the bad fuse.
  - ➢ When it is convenient, replace the spare fuse with another 1A 250V Fast-Blo fuse (AZI P/N 5100-1012).
- Replace the fuse compartment in the power receptacle.




# 7 CALIBRATION

The Jerome 431-X's gold film sensor is inherently stable and does not require frequent calibration. The interval between calibrations depends upon the application and frequency of use; however, the recommended minimum or maximum interval is every 12 months.

The Jerome 431-X has been factory calibrated using NIST traceable permeation tubes. In order to calibrate the Jerome 431-X, a sophisticated calibration system is required that ensures stability of the calibration gas source, eliminates any pressure in the calibration gas stream and controls the temperature of the calibration environment. Calibration also requires special proprietary software. This system has an estimated uncertainty of ±3.5%.

We strongly recommend you take advantage of our calibration and maintenance service at Arizona Instrument. A certificate of calibration is issued by Arizona Instrument when your instrument is factory calibrated to 0.100 mg/m$^3$. Two additional calibration points, 0.010 and 0.025 mg/m$^3$, are available upon request at additional charge. Contact Arizona Instrument Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining calibration.

## 7.1 Verification of Calibration and Quality Control

The Functional Test Kit, AZI P/N 4431-0902, is used to determine if your instrument is within calibration tolerances between recommended annual factory calibrations. If your application requires frequent verification of instrument function, this test demonstrates the unit's operation, calibration, and function. This test verifies proper instrument operation through the introduction of a known mass of mercury into the Jerome analyzer and allows you to have complete confidence in the sample results.

Recording the Functional Test Kit results in an instrument log provides a quality control/quality assurance record of instrument function between regular calibrations. As long as the test results fall within the expected range, you may assume the instrument is functioning correctly.

**THIS FUNCTIONAL TEST DOES NOT CALIBRATE THE INSTRUMENT.**

A complete description of the Functional Test Kit procedures is contained in Appendix A, beginning on page 29.

To order the kit, contact Arizona Instrument Technical Sales at 1-800-390-1414 or 1-602-470-1414.

# 8 431-X TROUBLESHOOTING

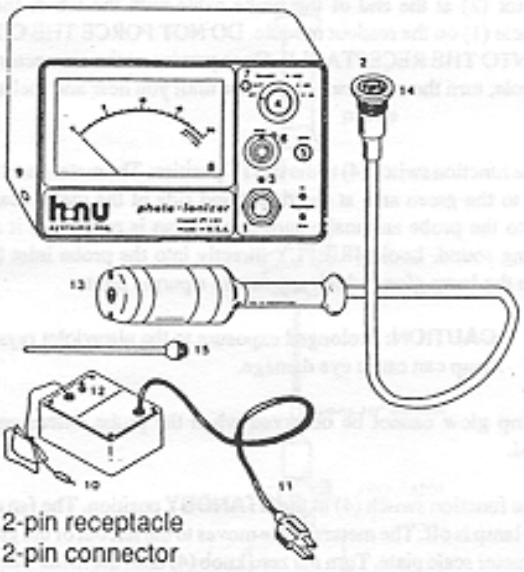
| Symptom | Possible Cause | Solution |
|---|---|---|
| **Power Problems** | | |
| Unit does not turn ON. LCD displays 000 when connected to power cord and ON button is pressed. | Dead battery | Recharge battery (minimum 14 hours) refer to page 13.<br><br>Replace battery, refer to page 17. |
| Unit does not turn on when connected to AC power cord. | Fuse<br><br>Insufficient power | Replace fuse, refer to page 19 .<br>Be sure there is power to the AC outlet using a volt meter. |
| **Regeneration & zero problems** | | |
| LCD displays .8.8.8. | Sensor saturated | Do not attempt to rezero. Unit must be regenerated. See page 10 for information. |
| LCD displays .L.L.L when taking first sample. | Changes in temperature | Readjust zero pot. See page 6 for information . |
| LCD displays H at finish of sensor regeneration | Internal contamination may redeposit mercury from flow system onto gold film sensor. | Remove and replace intake filter disk, Tygon™ tubing and internal C/M filter. Check tubing for kinks or crimps. Repeat regeneration cycle. See page 10 for information. |
| Zero adjust pot cannot be adjusted to 0 | Pot not turned sufficiently | Turn zero adjust up to 20 times to reach the end. Pot will “click” softly. |
| Display still unchanged | Sensor may be ruptured or pot may be broken | Turn pot slowly in opposite direction till display reads 0. If still unchanged, call AZI Customer Service. |

# MODEL PI-101

*Quick-Start*
Manual

# MODEL PI-101

readout module




1. 12-pin receptacle
2. 12-pin connector
3. high voltage switch
4. function switch
5. zero knob
6. span control
7. low battery indicator, LED
8. meter
9. charger minijack
10. charger miniplug
11. charger power cord
12. charger, LED
13. probe sample inlet
14. connector adapter ring
15. probe extension

Figure 1

# PREPARING FOR FIELD USE

Attach the probe to the readout module. Align the slot on the 12-pin connector (2) at the end of the probe cable with the tab in the 12-pin receptacle (1) on the readout module. DO NOT FORCE THE CONNECTOR INTO THE RECEPTACLE. Once you insert the connector into the receptacle, turn the connector clockwise until you hear and feel a distinct click.

Turn the function switch (4) to the **BATT** position. The meter needle should deflect to the green area at the right-hand side of the meter scale plate. Listen to the probe and make sure that the fan is operating; it makes a humming sound. Look BRIEFLY directly into the probe inlet (13) and observe the lamp glow, which appears as a purple light.

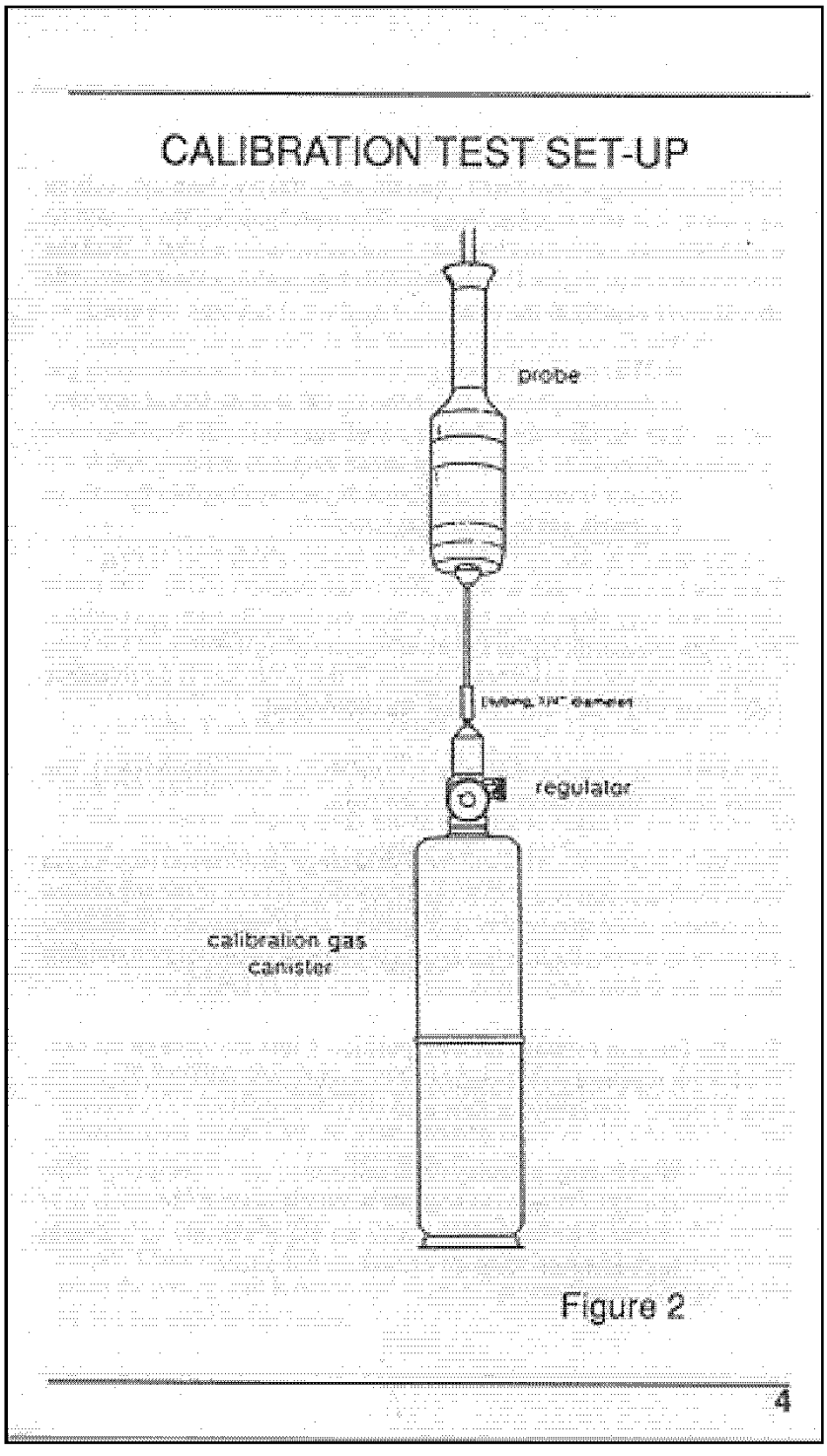
> **CAUTION:** Prolonged exposure to the ultraviolet rays of the lamp can cause eye damage.

The lamp glow cannot be observed when the probe extension (15) is attached.

Turn the function switch (4) to the **STANDBY** position. The fan operates and the lamp is off. The meter needle moves to the left out of the green area on the meter scale plate. Turn the zero knob (4) until the meter needle rests at 0. (The PI-101 can be electronically zeroed only while the function switch is in the **STANDBY** position).

Check the span setting (1.0 for 9.5 eV lamps, 9.8 for 10.2 eV lamps, 5.0 for 11.7 eV lamps) and adjust as necessary using the span control (6). Connect the regulator to the calibration gas canister (see figure 2). Using flexible tubing (three inches long is sufficient, one quarter inch diameter), connect the calibration gas to the probe inlet (13, Figure 1), and open the valve on the regulator. Use of the probe extension (15, Figure 1) is optional during this procedure.[1] Recheck the electronic zero and adjust as necessary.

Once the PI-101 is electronically zeroed, turn the function switch (3, Figure 1) to the **0-2000** range position (X100).



# CALIBRATION

HNU calibration gas consists of approximately 100 ppm isobutylene in an air matrix; it is referenced to benzene. The meter reading that should be obtained during calibration is marked on the gas canister label.[2] With the function switch (4, Figure 1) at the **0-2000** range position, the meter needle should move slightly to the right.

> **NOTE:** Any calibration gas used must have the same matrix gas as the atmosphere in which the PI-101 is used. Use of any other gas significantly affects the readings obtained. Readings may *appear* to be far higher or lower than they actually are. If the monitor is used in air, never use $N_2$ or any gas other than air, as the matrix gas in calibration standards.

Turn the function switch to the **0-200** range position (X10). The meter should read very close to the ppm number on the calibration gas canister. Adjust the span pot (6, Figure 1) until an exact reading is obtained. The span setting used to obtain an accurate reading in this procedure is the reference point from which all other readings are determined.

Turn the function switch (4, Figure 1) to the **0-20** range position (X1). The meter needle should deflect fully to the right.

Turn the function switch back to the **0-200** range position and recheck the meter reading to ensure that an accurate reading has held. Make any needed adjustments to the span control (6, Figure 1), and if necessary, recheck the accuracy by turning the function switch to the **0-20** range position and then back to the **0-200** range position.

Turn the function switch to the **OFF** position. Close the valve on the calibration gas regulator and disconnect it from the probe inlet (13, Figure 1). The PI-101 is now ready for field use.

> **NOTE:** High humidity (90% and above) affects sensitivity. This should be taken into account when calibrating. Readings may appear to be lower than actual, but use of a humid air matrix in the calibration standard minimizes this effect.

## CHARGING, (CONT.)

**NOTE:** If the particular PI-101 unit is a **GP PI-101** (General Purpose), it is not necessary that the probe be attached during the charging process. This is ONLY true for GP PI-101 units. All other types of PI-101 units MUST have the probe attached during the charging process.

The PI-101 can be left on charge whenever it is not in use. It cannot overcharge. The PI-101 can be operated when attached to the charger, however, charging time is longer than eight to ten hours.

## QUICK CHECKS

Charge did not "take". Is the probe attached? Is the high voltage switch completely depressed? Is the charger LED on? Is the charger output -15 VDC?

To check the charger output, use a voltmeter. The charger must be connected to an AC power supply during this process. Place the black (common) lead on the miniplug on the sleeve. Place the red (positive) lead on the tip of the miniplug. The correct voltage is +/- 15 VDC. If a positive voltage is read at this point, check the position of the voltmeter leads.

For more detailed information on the PI-101, consult the complete PI-101 manual, or contact HNU Systems, Inc.

[1] The probe extension may become contaminated during normal use and must be cleaned periodically. Use the same procedure as for ion chamber cleaning, which is described in Service Note 86-01 (included in this booklet). If the probe extension is used during calibration, it should be free of any contaminants to ensure an accurate calibration.

[2] Most calibration gas canisters supplied by HNU Systems, Inc., have a label stating a particular ppm to be read with a span setting of 9.8. This is the recommended span setting for the 10.2 eV lamp ONLY, which is the most commonly used lamp. Be sure to use the span setting recommended for the particular lamp that is used during the calibration; 1.0 for 9.5 eV lamps, 9.8 for 10.2 eV lamps, and 5.0 for 11.7 eV lamps.

# FAN CLEANING

## NEEDED:

Flat Screwdriver
Cotton Swabs
Clean Water

## DISASSEMBLY

Hold the probe with the cable up. With one hand supporting the end of the probe, remove the exhaust screw, located next to the cable. Gently slide the lamp housing out of the probe shell. Set the shell aside. Working on a flat surface, place the probe end down with the small printed circuit board upwards and facing you. Unplug the signal cable (#5) from the connector on the board. Remove the small screw holding the board in place (#4). Remove the board and set aside. Turn the housing around so that the flat side of the semicircular retainer (#1), is facing away. Remove the two standoff screws (#2). Gently grasp the copper-clad fan motor (#3) and retainer. Tilt the top away and the bottom towards you so that the fan blades are exposed.

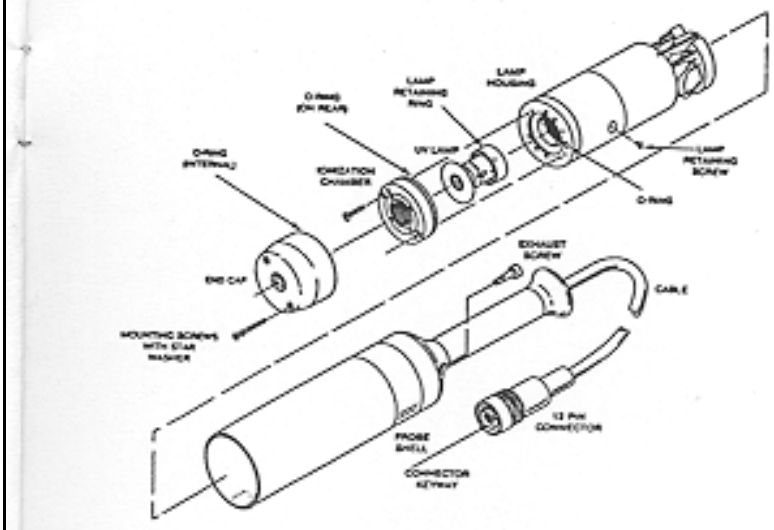
## CLEANING

Blow into the fan blades to remove any debris that may prevent their movement. If this does not free the blades, remove about 2/3 of the cottom from a swab, dampen it with clean water, and gently dab at and between the fan blades. Repeat as necessary. Allow a few minutes for the water to dry off.

## REASSEMBLY

Replace the fan with the blades face down in the circular output on the lamp housing. Replace the retainer and the two standoff screws. Tighten the screws enough to retain the fan cylinder, but loose enough to allow very slight rotation. Turn the housing around so that the flat side of the retainer is facing you. Replace the printed circuit board and secure with the small screw. Plug the signal cable onto the board Slide the housing into the shell. DO NOT FORCE IT IN. The housing fan fits into the shell only one way. The hole on the retainer must line up with the hold on the shell next to the cable. Replace the exhaust screw. Except for two small standoff screws, all other screws should be hand tight.

# PROBE ASSEMBLY



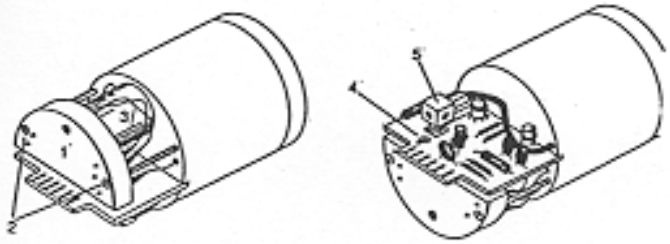


Figure 3

# APPENDIX B

# DECONTAMINATION PROCEDURES

# 405. DECONTAMINATION

## 405.1 Purpose

Personnel engaged in investigations or clean-up of sites for hazardous materials can become contaminated in several ways, including being splashed with liquid chemical products or contaminated water while drilling, developing, testing, and sampling wells; handling chemical wastes, contaminated soil or water, or contaminated equipment; walking on contaminated soil or through contaminated surface water; and contacting chemical vapors, dusts, fumes, and mists. Although protective clothing helps prevent the wearer from becoming contaminated, contamination can occur. Decontamination reduces dermal exposure time. It also prevents hazardous materials from being transferred from protective clothing to wearer and to clean areas where unprotected individuals can be exposed.

Decontamination consists of removing contaminated clothing and washing the skin to remove contaminants. How extensive the decontamination process must be depends primarily on the types of contaminants and the nature of on-site activities planned. As the toxicity of the contaminants and the magnitude of potential contamination of personnel are increased, the decontamination process becomes increasingly more extensive and thorough. This OP describes decontamination guidelines while procedures for field operations must be developed on a site-by site basis.

## 405.2 Responsible Authority

Decontamination operations at each hazardous waste site shall be supervised by the SSO. The SSO is responsible for ensuring that all personnel follow decontamination procedures and that all contaminated equipment is adequately decontaminated. The SSO is also responsible for maintaining the decontamination zone and managing the wastes generated from the decontamination process.

## 405.3 Decontamination of Personnel

Site activities should be conducted with the general goal of preventing the contamination of people and equipment. Using remote sampling techniques, bagging monitoring instruments, avoiding contact with obvious contamination, and employing dust suppression methods that would reduce the probability of becoming contaminated and, therefore, reduce the need and extent of decontamination. However, some type of decontamination will always be required on site. A sample personnel decontamination set-up guideline is included provided in Attachment 1 and sample decontamination equipment and supplies list is included in Attachment 2.

OSHA requires that proper PPE must be worn when operating steam or pressure washing equipment. A rain suit, boots, hard hat, and a face shield are recommended to be worn. Depending on the contaminant, a respirator is usually worn. All personnel must be kept out of the path of steam or water spray.

Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potential harmful effects of exposures to hazardous substances.

OSHA also requires that when hazardous waste clean-up or removal operation commences on a site and the duration of the work will require six months or greater time to complete, showers and change rooms must be provided for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations. It must be assured that employees will shower at the end of their work shift.

### 405.4 Decontamination of Equipment

Heavy equipment, hand tools, and sampling devices contaminated in the exclusion zone must be de-contaminated before re-use or removal from the site. Equipment and tools must be cleaned periodically to reduce continual contact with contamination. All equipment must be decontaminated before it is taken off-site to leave contamination on the site. Sampling equipment must also be decontaminated between samples to prevent cross-contamination of the samples.
All major reusable equipment and other tools used for site investigation activities should be decontaminated prior to leaving the site area. Cleaning should consist of scrubbing to remove encrusted materials followed by a detergent-and water wash and potable water rinse using a high-pressure low volume water spray or steam-cleaning unit. High pressure and/or heat should be used only as necessary and with caution because they can spread contamination and cause burns. Additional rinses with other solvents, such as methanol and hexane, may be used if warranted by the nature of the chemicals encountered. These solvents may present additional inherent hazards of chemical exposure and special precautions must be taken when handling these chemicals. An MSDS or other equivalent information must accompany the chemicals on-site.

Sampling equipment must be decontaminated to ensure the integrity of the samples and to prevent cross-contamination. It is common to use solvents and acids (e.g. acetone and nitric acid) to decontaminate equipment between samples. These chemicals must also be handled with care.

Decontamination should be performed at a designated equipment decontamination area on the site. An excavated sump may be used to collect wash water as needed. Following decontamination, the clean equipment should be stored on plastic sheeting.

The under carriage of all vehicles (e.g. trucks, etc.) should be cleaned prior to driving them off the site. At the conclusion of site work, all major equipment should be thoroughly cleaned using the method described above.

### 405.5 Level of Protection For Decontamination Personnel

In some cases, decontamination personnel should wear the same levels of PPE as workers in the Exclusion Zone. In other cases, decontamination personnel may be sufficiently protected by wearing protection of one level lower (e.g., wearing level C protection while decontaminating workers who are wearing level B protection). Because all decontamination workers are in a contaminated area they must be decontaminated before entering the clean support zone.

### 405.6 Decontamination Solution

A decontamination solution should be capable of removing, or converting to a harmless substance, the contaminant of concern without harming the object being decontaminated. The preferred solution is a mixture of detergent and water, which is a relatively safe option compared to chemical decontaminants. A solution recommended for decontaminating boot covers and gloves consists of 1 to 1.5 tablespoons of Alconox per gallon of warm water. Skin surfaces should be decontaminated by washing with hand soap and water. The decontamination solution must be changed when it no longer foams or when it becomes extremely dirty. Rinse water must be changed when it becomes discolored, begins to foam, or when the decontamination solution cannot be removed.

Organic or halogenated solvents may be needed to remove contaminants when detergents are not effective. These chemicals, themselves, present potential hazards of toxicity, flammability, and incompatibility with most types of PPE. Special handling and disposal procedures may be needed along with MSDS for the solvents.

### 405.7 Disposal of Decontamination Solutions

All decontamination solutions should be contained, collected, and packaged for disposal. Arrangements should be made with the client for disposal of the solutions. If the effluent is treatable it may be permissible to discharge it into a chemical or sanitary sewage system. Otherwise, it may need to be transported to a treatment facility. It is very important to generate minimum quantities of decontamination solutions.

### 405.8 Emergency Decontamination

Hazardous waste facilities should also have in place emergency decontamination procedures, in order to prevent the loss of life or severe injury to site personnel. In the case of threat to life, decontamination should be delayed until the victim is stabilized; however, decontamination should always be performed first, when practical, if it can be done without interfering with essential lifesaving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life. During an emergency, provisions must also be made for protecting medical personnel and disposing of contaminated clothing or equipment.

## 405.9 References


- EPA Standard Operating Safety Guidelines; Publication 9285.1-03, June 1992.
- The Code of Federal Regulations, Title 29, 1910.120; July 1, 1993.
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities; October 1985.

## ATTACHMENT 1
## SAMPLE PERSONNEL DECONTAMINATION FACILITY SET-UP

The decon facility should have a minimum of four stations: (1) segregated equipment drop station, (2) coverall, boot, and glove wash and rinse station, (3) coverall and outer glove removal station, and (4) respirator, boot, and inner glove removal station.

### Station 1—Segregated Equipment Drop

Deposit equipment used in the exclusion zone (e.g. tools, sampling devices and containers, monitoring equipment, radios, clipboards, etc.) on a plastic drop cloth or in plastic lined containers.

### Station 2—Boot Cover Wash And Rinse

Step into the first container of decontamination solution and scrub bottom and sides of boot covers up to taped area to remove gross contamination. After boot covers have been scrubbed, step into the second container of decontamination solution and repeat the washing process. Finally, step into container of rinse water and rinse boot covers thoroughly. Proceed to Station 3.

### Station 3—Outer Glove Wash And Rinse

Place gloved hands in container of decontamination solution and wash gloves. Use a brush if necessary. After washing the gloves, place hands in container of rinse water and rinse gloves thoroughly. This station and Station 2 may be combined into one station if protective equipment is not grossly contaminated.

### Station 4—Coverall And Outer Glove Removal

If used, remove tape from legs and wrists as well as from coverall zipper. Then, remove outer gloves and coverall, in that order. Care must be taken to prevent transfer of contaminants from coverall to underclothes. Transfer can be minimized by rolling or folding the coverall as it is being removed so that the coverall is turned inside-out. Place tape, coveralls, and outer gloves in the plastic-lined receptacle provided at this station.

Remove respirator and boots and place them in receptacles provided at this station. Remove inner gloves and discard in receptacle provided.

### Station 6—Hand And Face Wash And Street Shoe Donning

Wash, rinse and dry hands and face, then don street shoes. If highly toxic, corrosive, or skin absorbable chemicals are known to be present, a shower facility should be set-up in the support area and personnel required to shower before leaving the site.

## ATTACHMENT 2
## SAMPLE DECONTAMINATION EQUIPMENT AND SUPPLIES

- One or two plastic drop cloths, minimum thickness of 3 mills and minimum size to 9x12 feet.
- Four to seven containers, 30- to 50-gallon capacity (galvanized tub, stock tank, or children's wading pool), for washing and rinsing.
- One or two receptacles (drums of plastic trashcans) for receiving contaminated disposable equipment and trash.
- One or two 55-gallon drums for storage of contaminated wash and rinse water.
- Plastic trash bags of different sizes for temporary storage of contaminated equipment and for lining trash receptacles.
- Two to four long-handled soft bristled brushes (e.g. toilet brush).
- Three to four-inch diameter plastic pipe or 4x4-inch timber (or other methods) to raise edges of drop cloth to contain contaminated wash and rinse water spilled during decontamination.
- Detergent (e.g. Alconox)
- Hand soap
- Fresh water
- Paper towels for drying hands, face, and equipment.
- Chairs or benches for personnel to sit on while removing boots.
- Shower facility with lockers (optional).

# ATTACHMENT 1

# EMPLOYEE ACKNOWLEDGEMENT

BROWN AND CALDWELL

# HASP Employee Acknowledgment Form



| Employee Name | |
|---|---|
| Project Name<br>Phase II Remedial Investigation at LCP Chemicals, Inc. Superfund Site | Project Number<br>127806 |

**Employee Statement of Acknowledgment**

**I hereby certify that I have read and that I understand the safety and health guidelines contained in Brown and Caldwell's Field Work Safety Plan for the above-named project.**

_____ _____

**Employee Name** **Date**

In the Case of an Emergency, contact:

| Name | Relationship | Telephone Number |
|---|---|---|
| 1. | | |
| 2. | | |

Name of Project Manager Receiving this Form

| Signature of Site Safety Coordinator | Date |
|---|---|
| | |

**NOTE: Place completed form in project file.**

HS—10 REV. 06/98

# ATTACHMENT 2

# DAILY TAILGATE MEETING RECORD

BROWN AND CALDWELL

# HASP Daily Tailgate Meeting Record



| Name of Project/Site: | Project No: |
|---|---|
| Project/Site Location: | |
| Employee Completing Form:<br>(Print and Sign): | Date: |

**Employee Acknowledgement:**

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

**Important Notice to Subcontractor(s):**

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

BC's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

| Print | Sign | Date | Print | Sign | Date |
|---|---|---|---|---|---|
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**Plan of the Day**

(Describe the activities that are planned to be performed today)

**Potential Hazards and Topics Discussed**

(Describe the potential hazards and controls that may be associated with planned activities)

☐ Electrical ☐ Chemical ☐ Biological ☐ Physical ☐ Other (specify):

# ATTACHMENT 3

# SAFETY PLAN IMPLEMENTATION CHECKLIST

BROWN AND CALDWELL

# HASP Checklist Form



Instructions: Complete this form immediately prior to project start.

| **Name of Project/Site:** | **Project No:** |
|---|---|
| **Project/Site Location:** | |
| **Employee Completing Checklist:** (Print and Sign): | **Date:** |

| Yes | No | N/A | | Yes | No | N/A | |
|---|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | Written Health and Safety (H&S) Plan is on site? | ☐ | ☐ | ☐ | Respirators are available, properly cleaned, and stored? |
| ☐ | ☐ | ☐ | Addenda to the H&S Plan are documented on site? | ☐ | ☐ | ☐ | Overhead utilities do not present a hazard to equipt./personnel? |
| ☐ | ☐ | ☐ | H&S Plan information matches conditions/activities at the site? | ☐ | ☐ | ☐ | Traffic control measures have been implemented? |
| ☐ | ☐ | ☐ | H&S Plan read/signed by all site personnel, including visitors? | ☐ | ☐ | ☐ | Trenches and excavations are safe for entry? |
| ☐ | ☐ | ☐ | Daily tailgate H&S meetings have been held/documented? | ☐ | ☐ | ☐ | Soil Spoils are at least 2 feet from the edge of the excavation? |
| ☐ | ☐ | ☐ | Site personnel have required training and medical? | ☐ | ☐ | ☐ | Emergency/FA equipt. is on site as described in the H&S Plan? |
| ☐ | ☐ | ☐ | Air monitoring is performed/documented per the H&S Plan? | ☐ | ☐ | ☐ | Drinking water is readily available? |
| ☐ | ☐ | ☐ | Air monitoring equipment has been calibrated daily? | ☐ | ☐ | ☐ | Phone is readily available for emergency use? |
| ☐ | ☐ | ☐ | Site zones are set up and observed where appropriate? | ☐ | ☐ | ☐ | Utility locator has cleared subject locations? |
| ☐ | ☐ | ☐ | Access to the work area limited to authorized personnel? | ☐ | ☐ | ☐ | Proper drum and material handling techniques are used? |
| ☐ | ☐ | ☐ | Decontamination procedures followed/match the H&S Plan? | ☐ | ☐ | ☐ | Waste containers/drums are labeled appropriately? |
| ☐ | ☐ | ☐ | Decontamination stations (incl. hand/face wash) are set up and used? | ☐ | ☐ | ☐ | Ext. cords are grounded/protected from water/vehicle traffic? |
| ☐ | ☐ | ☐ | PPE used matches H&S Plan requirements? | ☐ | ☐ | ☐ | Tools and equipment are in good working order? |
| ☐ | ☐ | ☐ | Hearing protection used where appropriate? | ☐ | ☐ | ☐ | GFCIs used for portable electrical tools and equipment? |

**Notes**

*(All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here):*

# ATTACHMENT 4

# NOTICE OF UNSAFE CONDITIONS

BROWN AND CALDWELL

# HASP Notice of Unsafe Conditions Form



| Contractor | Date |
|---|---|
| Project Name | Project Number |

**THIS NOTICE . . .**

**This notice is to advise you, the Prime Contractor on the above-named Contract, that this Representative of the Owner of the above-mentioned Project has observed (on the date shown above) an unsafe condition on the Project.**

**These conditions are listed as follows:**

| ITEM | CONDITION |
|---|---|
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By this Notice, the Owner or its Representatives shall not assume any responsibility under the GENERAL CONDITIONS or assume any liability for the existence or correction thereof, for the unsafe conditions, or any others that may have been unnoticed.
These conditions shall be remedied as soon as possible within a safe working period. If these corrections are not made, the Owner will be forced to remove all field staff from the job. No payment shall be made for any work installed after this date without first examination of work in accordance with the GENERAL CONDITIONS.

| Signature of Owner's Representative | Title | Date |
|---|---|---|
| Received by (Signature of Contractor's Representative) | Title | Date |

**NOTE: Place a copy of completed form in project file.**

HS—13 REV. 06/98

# ATTACHMENT 5

# DAILY AIR MONITORING RECORD

BROWN AND CALDWELL

# HASP Daily Air Monitoring Record

Page_____of_____

Instructions: Complete this form daily during air monitoring.

| Name of Project/Site: | Project No: |
|---|---|
| Project/Site Location: | |
| Employee Performing Air Monitoring: (Print and Sign): | Date: |

## Photo Ionization/Flame Ionization Detectors (PIDs/FIDs)

| ☐ PID ☐ FID | Manufacturer: | Model: | Serial #: |
|---|---|---|---|
| Initial Calibration Reading: | | End-of-Use Calibration Reading: | |
| Calibration Standard/Concentration: | | | |

## Mini-RAM Dust Monitor

| Manufacturer: | Model: | Serial #: |
|---|---|---|
| Zeroed in Z-Bag? ☐ Yes ☐ No | | |

## Monitoring Data

| Time | Location and Activity | PID/FID (ppm) | Mini-RAM ($mg/m^3$) | Time | Location and Activity | PID/FID (ppm) | Mini-RAM ($mg/m^3$) |
|---|---|---|---|---|---|---|---|
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Place a copy in the project file

# ATTACHMENT 6

# ACCIDENT/INCIDENT INVESTIGATION REPORT FORM

BROWN AND CALDWELL

# HASP Accident/Incident Investigation Report Form



**Instructions:**

If an accident or incident occurs, complete all applicable information in this form, make a copy for your records, and immediately forward the original to the office Health and Safety Coordinator (HSC). If fields are not applicable, indicate with "N/A". Use separate sheet(s) if necessary and attach sketches, photographs, or other information that may be helpful in understanding how the accident/incident occurred.

HSC – Review and enter report into the BC Online Safety Observation and Incident Reporting System within 3 workdays of receipt. File original in appropriate office health and safety file.

**NOTE:**

This report is important – please take the time necessary to properly complete it. Incomplete reports will be forwarded to appropriate management for review and action.

## General Information

| | | | |
|---|---|---|---|
| **Date of Accident/Incident** | **Time of Accident/Incident:** | **Date Accident/Incident Reported:** | **To Whom:** |
| **Exact Location of Accident/Incident** (Street, City, State)**:** | | | **BC Office:** |
| **Name Project:** | | | **Project Number:** |
| **Employee Completing the Investigation** (Print and Sign)**:** | | | **Date:** |

## Injured/Ill Employee/Property Damage Information

| | | | |
|---|---|---|---|
| **Employee Name:** | **Employee No.** | **Department:** | **Phone Number:** |
| **Job Title:** | | **Manager's Name and Phone Number:** | |
| **Nature of Injury/Illness** (laceration, contusion, strain, etc.)**:** | | **Body Part Affected** (arm, leg, head, hand, etc.)**:** | |
| **Describe Property Damage and Estimate Loss** : | | | |

## Description of Accident/Incident

Describe the accident sequentially, beginning with the initiating event, and followed by secondary and tertiary events. End with the nature and extent of injury/damage. Name any object or substance and tell how they were included. Examples: 1) Employee was pulling utility cart that was loaded with wastepaper from office area to hallway. Wheel of utility cart caught against door casing. Bags of heavy wastepaper that were in cart fell to end of cart. Cart tipped over onto foot of employee. Right foot was crushed between utility cart and door casing, resulting in severe contusion to right foot of employee. 2) Employee was driving rental car from office to project site. Car struck icy section of road. Employee lost control of vehicle, which skidded across road into concrete abutment on side of road. Accident resulted in damage to right fender, tire, headlight, and grill.

# HASP Accident/Incident Investigation Report Form



## Analysis of Accident Causes

### Immediate Causes - Substandard Actions

What substandard actions caused or could have caused the accident/incident? State the actions on the part of the employee or others that contributed to the occurrence of the accident/incident. Examples: 1) Employee overloaded the utility cart with wastepaper. 2) Employee exceeded safe speed on icy road, and was inattentive to hazard.

**Codes (check all that apply)**

- ☐ 1. Operating equipment without authority
- ☐ 2. Failure to warn
- ☐ 3. Failure to secure
- ☐ 4. Operating at improper speed
- ☐ 5. Making safety devices inoperable
- ☐ 6. Removing safety devices
- ☐ 7. Using defective equipment
- ☐ 8. Using equipment improperly
- ☐ 9. Failure to use PPE properly
- ☐ 10. Improper loading
- ☐ 11. Improper placement
- ☐ 12. Improper lifting
- ☐ 13. Improper position for task
- ☐ 14. Servicing equipment in operation
- ☐ 15. Horseplay
- ☐ 16. Alcohol or drug influence
- ☐ 17. Other (specify)

### Immediate Causes - Substandard Conditions

What substandard conditions caused or could have caused the accident/incident? State the conditions that existed at the time of the accident (the specific control factors that were or may have been the direct or immediate cause or causes of the accident). Examples: 1) Wheel of utility cart was worn and would not roll properly; utility cart was overloaded with wastepaper. 2) Road was covered with icy spots; weather was foggy.

**Codes (check all that apply)**

- ☐ 1. Inadequate guards or barriers
- ☐ 2. Inadequate or improper PPE
- ☐ 3. Defective tools, equipment, or materials
- ☐ 4. Congestion or restricted action
- ☐ 5. Inadequate earning system
- ☐ 6. Fire and explosion hazards
- ☐ 7. Poor housekeeping
- ☐ 8. Noise exposures
- ☐ 9. Radiation exposures
- ☐ 10. High or low temperature exposures
- ☐ 11. Inadequate or excess illumination
- ☐ 12. Inadequate ventilation
- ☐ 13. Hazardous environ. conditions (vapors, dusts, etc.)
- ☐ 14. Other (specify)

### Basic Causes - Personal and Job Factors

What personal and/or job factors caused or could have caused the accident/incident? State the influencing factors or underlying causes, either conditions or actions or both, that contributed to the accident/incident. Examples: 1) Employee had not been instructed in overloading hazards. 2) Employee had not been trained in driving under winter conditions; company has no driver training program.

**Codes (check all that apply)**

**Personal Factors**

- ☐ 1. Inadequate capability
- ☐ 2. Lack of knowledge
- ☐ 3. Lack of skill
- ☐ 4. Improper motivation
- ☐ 5. Other (specify):_____

**Job Factors**

- ☐ 1. Inadequate leadership/supervision
- ☐ 2. Inadequate engineering
- ☐ 3. Inadequate purchasing
- ☐ 4. Inadequate maintenance
- ☐ 5. Inadequate tools/equipment
- ☐ 6. Inadequate work standards/procedures
- ☐ 7. Inadequate Wear and tear
- ☐ 8. Abuse or misuse
- ☐ 9. Other (specify):

## Remedial Actions

Describe the actions taken or planned to prevent recurrence of accident/incident - provide the implementation date and person responsible for any planned corrective action.. Examples: 1) Wheels of utility cart were replaced with larger size wheels; all carts were inspected for safe operation; employees were instructed in overloading hazards. 2) All project personnel were instructed at the safety training meeting on driving under hazardous conditions; driver training program will be implemented.

**Codes (check all that apply)**

**Job Factors**

- ☐ 1. Reinstruction of personnel involved
- ☐ 2. Reprimand of personnel involved
- ☐ 3. Temporary/permanent reassignment of personnel
- ☐ 4. Action to improve clean-up
- ☐ 5. Equipment repair or replacement
- ☐ 6. Improve design
- ☐ 7. Improve construction
- ☐ 8. Improve PPE
- ☐ 9. Install of safety guard or device
- ☐ 10. Work method change
- ☐ 11. Order use of safer materials
- ☐ 12. Regional Safety Unit Manager Review
- ☐ 13. Other (specify):